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Ensuring That Army Infrastructure Meets Strategic Needs

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Prepared for the United States Army

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Preface

This documented briefing reports the results of a study entitled “Developing a Program of Research for Army Infrastructure Analysis.” The purpose of the study was to review Department of Defense (DoD) and Army strategic documents and initiatives to identify issues affecting Army infrastructure over the medium to long term. It also identified areas where additional information is needed to help the Army manage its infrastructure to ensure that it meets current and future needs.

This document discusses the implications of DoD and Army strategic documents for Army installations, assesses whether these implications are addressed by DoD- and Army-level installation strategic plans, and identifies gaps that should be addressed by infrastructure strategic planning efforts. It also describes the types of data and other information that will be needed to support these efforts. The findings should be of interest to those involved in infrastructure and installation management, provision of training land and ranges, and environmental issues.

This document primarily addresses strategic initiatives that were ongoing during fiscal year 2006. Additional initiatives associated with changes in stationing and training schedules have emerged more recently (such as “Grow the Army”) that are not covered by this study. However, the initiatives we discuss (including Modularity, the Global Defense Posture Review, the Army Force Generation Model, and Base Realignment and Closure) provide a range of example issues affecting Army infrastructure over the medium to long term.

This research was sponsored by the Deputy Assistant Secretary of the Army for Strategic Infrastructure and conducted within the RAND Arroyo Center’s Military Logistics Program. RAND Arroyo Center, part of the RAND Corporation, is a federally funded research and development center sponsored by the United States Army.

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Summary

This documented briefing discusses the results of a study that examined Department of Defense (DoD) and Army strategic documents to identify issues that affect the Army's infrastructure needs. It also reviews DoD- and Army-level installation planning documents to determine how well these issues are currently being addressed. Where gaps exist, it identifies areas that should be included in strategic planning activities to ensure that the Army's infrastructure meets current and future needs. Finally, it discusses the types of data that would be needed to assess projected demand for and supply of infrastructure, existing sources of these data, and areas where additional data collection efforts may be needed.

Implications of DoD and Army Strategic Plans and Initiatives

We first examined national strategic-level documents, including the *National Security Strategy*, the *National Defense Strategy*, and the *National Military Strategy*. These documents have all been revised in the last five years to reflect changes in the international security environment since the terrorist attacks of September 11, 2001. Trends that are likely to affect the Army's infrastructure needs are a continuing high pace of deployment; uncertainty about when, where, and for what purpose forces will be deployed; rotation of forces to cover extended operations; a need to sustain forces in distant, austere environments; and continuing joint, interagency, and multinational operations. At home, there is an increased emphasis on force protection and security, as well as providing support to civilian authorities in national emergencies.

The changes in national strategic documents are reflected in other DoD and Army planning documents and initiatives that have more direct implications for infrastructure and stationing. The Global Defense Posture Review (GDPR) moves forces from long-established bases in Europe and Asia back to the United States and envisions shorter rotations of forces to more austere Forward Operating Sites. To support sustained deployed operations, the Army is developing more modular tactical organizations, establishing unit rotation cycles under the Army Force Generation Model (ARFORGEN), and stabilizing the assignment of soldiers to units during rotation cycles. Specific implications for installations include requirements for access to strategic lift and improved connectivity to support mission planning and situational awareness, reachback operations, education, and communication with families.

In addition to supporting these initiatives, Army installations must implement the recommendations of the 2005 Base Realignment and Closure (BRAC) Commission by 2011. The Army's BRAC proposals integrated the stationing of new modular brigades as well as the return of overseas units. Other recommendations affecting the Army include the consolidation of training centers and schools; relocation of Forces Command, Training and

Doctrine Command, and Army Materiel Command headquarters; and movement of support activities out of leased office space in the Washington, D.C., region onto installations.

As a result of GDPR, BRAC, and the transformation to modular brigades, the Army will be moving about 150,000 military and civilian positions over the next five to six years, mostly onto U.S. installations. The military construction funding needed to build operational facilities is estimated at \$4 billion, not including community and morale, welfare, and recreation facilities needed to support soldiers and their families.

These initiatives also have implications for the Army's use of its training land and ranges. The location of additional units on U.S. installations is likely to result in more intensive use of existing training capacity. The *Army Modernization Plan* emphasizes the importance of Live-Virtual-Constructive training, which requires connectivity between training institutions, home stations, combat training centers, and deployed units. New weapon systems, such as the Future Combat System and Unmanned Aerial Vehicle systems, will likely require additional training space and facilities.

We also examined the implications of strategic documents on homeland security for Army installations. DoD missions related to homeland security include homeland defense (protecting the U.S. against external threats) and defense support of civil authorities, such as responding to terrorist incidents and natural disasters. Although most of the infrastructure and stationing implications of these documents overlap those of the *National Defense Strategy* and *National Military Strategy*, they place additional emphasis on some areas, such as force protection, mission assurance, and training requirements for dual-capable forces intended to support both domestic emergency and warfighting missions.

Mapping to Installation Strategic Plans

The *Defense Installations Strategic Plan* and the *Army Installation Strategic Plan* echoed some of the themes identified in the DoD and Army strategic documents.¹ These included the implications of more joint service operations and coordination, anti-terrorism and force protection concerns, and the quality of facilities and services, including housing and community facilities. The installation strategic plans also emphasized management issues that are not included in DoD and Army strategic documents. These included sustainability and sound natural resource management; the need to maintain and renovate installation assets on a limited budget; compliance with common standards and metrics; and greater collaboration and interaction with organizations outside the installation fence-line. Some of these issues, such as preventing encroachment that causes testing and training restrictions and implementing ecosystem management to address threatened and endangered species problems, are strategic for Army installations but are not mentioned in DoD and Army strategic documents.

¹ Individual Army installations also develop their own installation strategic plans. However, the focus of this study was on DoD and Army guidance for installation strategic plans rather than on individual installation strategic plans.

However, in some ways the *Defense Installations Strategic Plan* and the *Army Installation Strategic Plan* are not truly strategic. They tend to focus on current problems and known changes over the next five to six years. It is also unclear how installations will be able to meet the goals outlined in the plans within currently planned budgets.

Some installations are undertaking long-term strategic planning efforts called installation sustainability plans. These plans focus on creating sustainable, enduring installations by addressing mission, community, and environmental issues. The planning process involves setting goals and objectives over a 20- to 25-year horizon. However, initial plans have mostly focused on environmental issues and are not addressing quality of life or master planning issues as thoroughly. They also vary in focus and scope. They could benefit from some higher-level guidance on issues to be addressed and a broader perspective that includes common needs and potential synergies across installations.

Several of the installation-related implications of DoD and Army strategic documents and initiatives did not seem to be fully addressed by the *Defense Installations Strategic Plan* and the *Army Installation Strategic Plan*. These included

- more specific guidance on accommodating expected changes in stationing, such as long-term planning impacts of siting new facilities, maintaining quality of life for soldiers and families, and facilities needed at new Forward Operating Sites and Cooperative Security Locations envisioned by GDPR
- infrastructure needed to support more frequent deployments, such as access to strategic lift, loading and unloading capabilities, connectivity to deployed forces, and family support services
- implications of increased joint training and introduction of new technology for training space and facilities.

Most of the changes foreseen by DoD and Army strategic documents and initiatives will be completed in the next five to ten years. Over a longer time horizon, hedging against uncertainty and risk becomes more important. Hence, it is important for the Army to consider the assumptions that underpin current policies, particularly those associated with the demand for infrastructure and its supply. Since strategy can change more quickly than infrastructure, installations should retain sufficient capacity to be able to respond to changes in conditions.

Issues for Infrastructure Planning

There are a number of areas that should be included in strategic infrastructure planning to help the Army ensure that its installations and infrastructure meet its current and future strategic needs. The following issues do not appear to be fully incorporated into strategic infrastructure planning efforts:

- identifying the implications of modularity, ARFORGEN, and GDPR on the infrastructure needed to support deployments
- assessing current and future training capacity and the need for additional training land and ranges to (1) accommodate changes due to modularity, ARFORGEN, GDPR, and BRAC, (2) support more joint training, and (3) address the implications of new technology
- analyzing long-term infrastructure risks and uncertainties that the Army or DoD should hedge against
- developing innovative approaches to maintain quality of life for soldiers and their families, such as public/private or Army/community partnerships
- examining the infrastructure required to support operational capabilities and quality of life at the Forward Operating Sites and Cooperative Security Locations envisioned by GDPR
- evaluating the sustainability of current and planned training range usage
- identifying other federal lands with similar ecosystems and species to those found on Army bases to relieve environmental pressures
- conducting an analysis of farmland near Army bases that could be preserved as buffer space
- assessing installation sustainability plans and developing strategic guidance to enhance them.

Data Collection and Metrics

Generally speaking, there are several broad categories of data that are needed to assess these strategic issues and incorporate them into strategic infrastructure planning. First, operational data are needed on the types of units stationed at each installation, their equipment and personnel, and their expected levels of activity. These operational data can be related to requirements for infrastructure based on planning factors, such as the area of land needed to conduct a training event. Second, data on the current availability and quality of Army infrastructure are needed to determine whether requirements are being met and where gaps exist. Third, data on the capital and operating costs of various types of infrastructure are needed to evaluate the cost implications of alternative approaches to meeting infrastructure requirements. Fourth, data on the use of and satisfaction with family and community facilities and services are needed to gauge the effectiveness of these services. A fifth type of data involves land use and environmental conditions, such as the location of threatened and endangered species and their habitats, both on Army installations and on other land with similar habitats. Lastly, data are needed about installation, community, and industry sustainability approaches and practices.

Most of these data are currently available in some form or another, but they are scattered across multiple data sources managed by a variety of Army and external

organizations. In some cases, information is gathered into centralized databases, but in others, it would need to be collected from each installation or from multiple documents or organizations. Some types of operational data, such as the size of training areas that will be needed by new weapon systems, as well as environmental data for non-Army lands, appear to be particularly difficult to obtain.

Even when centralized data sources exist, related data may be spread across multiple systems or entered separately into more than one system, creating the potential for discrepancies and the need for data users to reconcile conflicting sources. Databases may be updated on different schedules, so it can be difficult to establish a common baseline. Planning factors may need to be reviewed to ensure that they reflect ongoing changes. A more integrated data collection system, based on standardized data definitions and updated more frequently (or even continuously), would help the Army better manage its infrastructure.

Conclusions

The Army's installations face both short-term and long-term challenges in adapting to changes in the strategic environment and responding to DoD and Army initiatives. Over the next five to six years, installations will need to accommodate changes in stationing and training schedules due to modularity, GDPR, ARFORGEN, and BRAC. Over the longer term, installations will need to be able to support more frequent deployments, adapt the use of training land and facilities to meet the needs of new technology and more joint training, and respond to encroachment and environmental challenges, such as addressing pressure due to growth in surrounding communities and preserving cultural and natural resources. In addition, the Army should consider what long-term risks and uncertainties could affect the future demand or supply of Army infrastructure and how best to hedge against these risks.

Since many of these issues cut across Army lines of responsibility, the office of the Deputy Assistant Secretary of the Army for Strategic Infrastructure could play an important role in coordinating strategic planning efforts to ensure that Army infrastructure meets current and future needs. It can also be a proponent for more integrated, accurate, and timely infrastructure databases that are needed to assess long-term infrastructure issues.

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Acronyms

1AD	1st Armored Division
1ID	1st Infantry Division
4ID	4th Infantry Division
ACR	Armored Cavalry Regiment
ADA	Air Defense Artillery
AMF	Army Modular Force
ARFORGEN	Army Force Generation Model
ARI	Army Research Institute for the Behavioral and Social Sciences
ASIP	Army Stationing and Installation Plan
BCT	Brigade Combat Team
BRAC	Base Realignment and Closure
CFSC	Community and Family Support Center
CS	Combat Support
CSS	Combat Service Support
DASA(SI)	Deputy Assistant Secretary of the Army for Strategic Infrastructure
DMDC	Defense Manpower Data Center
DoD	Department of Defense
DSCA	Defense Support of Civil Authorities
FCS	Future Combat System
FY	Fiscal Year
GAO	Government Accountability Office
GDPR	Global Defense Posture Review
GIS	Geographic Information System
HBCT	Heavy Brigade Combat Team
HQ	Headquarters
HQDA	Headquarters, Department of the Army
HSPD	Homeland Security Presidential Directive

IBCT	Infantry Brigade Combat Team
ISR	Installation Status Report
MP	Military Police
NIBD	Net Income Before Depreciation
PGP	Power Generation Platform
PGSP	Power Generation Support Platform
POM	Program Objective Memorandum
QDR	<i>Quadrennial Defense Review</i>
RDAT&A	research, development, acquisition, testing, and evaluation
RPLANS	Real Property Planning and Analysis Systems
SAIC	Science Applications International Corporation
SBCT	Stryker Brigade Combat Team
UAV	Unmanned Aerial Vehicle
WMD	Weapons of Mass Destruction

1. Introduction



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Ensuring That Army Infrastructure Meets Strategic Needs

This briefing first discusses the results of a review of Department of Defense (DoD) and Army strategic documents and initiatives to identify issues that are likely to affect the Army's infrastructure needs. Next, it examines DoD- and Army-level installation strategic plans (namely, the *Defense Installations Strategic Plan* and the *Army Installation Strategic Plan*) to determine whether these issues are currently being addressed. It then suggests areas that should be included in strategic planning efforts to help the Army ensure that its infrastructure meets current and future needs. Finally, it discusses the availability of the types of data that would be needed to support strategic infrastructure planning in these areas.

For the purposes of this study, *infrastructure* is defined broadly to include not only the land, buildings, and other facilities needed for the operation, training, support, and deployment of military forces, but also those needed to support Army families and communities and the personnel who provide related services.

Project Objective and Tasks

- **Objective: Identify key policy issues and critical information requirements for long-term Army infrastructure planning**
- **Tasks:**
 - **Identify the implications of Army and joint strategic plans and initiatives for infrastructure**
 - **Assess whether any critical infrastructure considerations are missing from Army and joint strategic planning**
 - **Assess whether DoD and Army installation strategic plans and initiatives address critical infrastructure objectives**
 - **Identify critical themes and priorities for strategic infrastructure planning efforts**
 - **Recommend improvements in data collection capabilities and metrics**

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The objective of this study is to identify key issues that the Army's strategic infrastructure policy should address. This document reports on five research tasks: **Identify the implications of Army and joint strategic plans and initiatives for infrastructure.** Through a review of Army and joint strategic plans and initiatives, we attempted to identify the major themes that the Army should expect to address over the next ten to twenty years. These plans and initiatives include the *National Security Strategy*, *National Defense Strategy*, and *National Military Strategy*, as well as DoD and Army plans and initiatives that flow from these documents, including the Global Defense Posture Review (GDPR), the Army Campaign Plan, the Army Modular Force Plan, and the 2005 Base Realignment and Closure (BRAC) decisions. Because these plans and initiatives affect the roles, desired capabilities, and desired characteristics of Army infrastructure, this task is intended to formulate the set of strategic issues that the Army infrastructure community will have to face in the foreseeable future.

Assess whether any critical infrastructure considerations are missing from Army and joint strategic planning. The Army and joint strategic plans reviewed under the first task may not contain all of the issues expected to affect Army infrastructure. We also reviewed the strategic plans of the Department of Homeland Security to identify additional expected

roles for DoD and Army infrastructure that have not yet been incorporated into DoD and Army strategic plans.

Assess whether DoD- and Army-level installation strategic plans and initiatives address critical infrastructure objectives. Under this task, we reviewed the strategic plans and initiatives of the Assistant Secretary of the Army for Installations and Environment and the Assistant Chief of Staff for Installation Management, as well as the *Defense Installations Strategic Plan* produced by the Office of the Deputy Under Secretary of Defense for Installations and Environment, to see how well they address the strategic issues identified in the first two tasks.²

Identify critical themes and priorities for strategic infrastructure planning. The purpose of this project is to determine whether DoD- and Army-level installation strategic plans and initiatives are adequately addressing the strategic issues expected to confront the Army infrastructure community. We identify several issues that should receive more attention in strategic planning efforts to ensure that the Army has the types of infrastructure it will need to meet expected strategic needs.

Recommend improvements in data collection capabilities and metrics. To measure how well current and projected infrastructure capabilities meet Army strategic needs, the Army may need to develop new data collection capabilities and metrics. Using the themes we identified in the previous task as a starting point, we discuss the types of metrics and supporting data needed to measure capabilities in these areas, and we examine existing databases to determine whether the necessary data are currently being collected.

² Individual Army installations also develop their own installation strategic plans. However, the focus of this study was on DoD and Army guidance for installation strategic plans rather than individual installation strategic plans.

Outline

- **Implications of DoD and Army strategic plans and initiatives**
- **Mapping to installation strategic plans**
- **Issues for infrastructure planning**
- **Data collection and metrics**

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The remainder of this document is divided into four sections. The first section discusses a review of Army and joint strategic plans and initiatives, as well as Department of Homeland Security strategic plans and their implications for Army infrastructure over the next ten to twenty years. Strategic plans and initiatives reviewed include the following:

- *National Security Strategy*
- *National Defense Strategy*
- *National Military Strategy*
- Global Defense Posture Review (GDPR)
- Overseas Basing Commission report
- *Base Realignment and Closure Commission Report*
- *Quadrennial Defense Review (QDR)*
- *Army Strategic Planning Guidance*
- *Army Campaign Plan*
- Army Game Plan
- Army white paper “Serving a Nation at War”
- *Army Transformation Roadmap*

- *Army Modernization Plan*
- Army Modular Force Plan
- Army Force Generation Model (ARFORGEN)
- *National Strategy for Homeland Security*
- *Strategy for Homeland Defense and Civil Support*

The second section reviews DoD- and Army-level installation strategic plans to determine whether they address the infrastructure implications of Army and joint operational strategic plans and initiatives. The third section identifies strategic concerns that are not currently being adequately covered by DoD- and Army-level installation strategic plans. The final section discusses the types of data that would be needed to support strategic planning efforts in these areas, as well as existing sources of these data. The specific data needs for each of the strategic infrastructure issues are discussed in greater detail in Appendix C.

2. Implications of DoD and Army Strategic Plans and Initiatives

Implications of National Security, Defense, and Military Strategies for Infrastructure and Stationing

- **Future strategic framework implies:**
 - **Continuing deployment of forces**
 - **Uncertainty about when, where, and for what**
 - **Rotation of forces to cover extended operations**
 - **Need for force protection and security**
 - **Need to sustain forces in distant, austere environments**
 - **Continuing joint, interagency, and multinational operations**
 - **Support to civilian authorities in national emergencies**

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We first examined the nation's strategic-level planning documents to identify implications for Army infrastructure and stationing. These documents have been revised in the past five years to reflect changes in perceived threats since September 11, 2001, and the beginning of the Global War on Terrorism.

Defense planning in the United States proceeds from three strategic-level documents. At the pinnacle is *The National Security Strategy of the United States of America*, promulgated by the Executive Office of the President (2006). *The National Security Strategy* provides the foundation for the other two documents, which are derivative: *The National Defense Strategy of the United States of America*, published by the Office of the Secretary of Defense (2005), and *The National Military Strategy of the United States of America*, prepared by the Chairman of the Joint Chiefs of Staff (2004). The latest *National Security Strategy* was published in March 2006, replacing the 2002 version. The latest *National Defense Strategy*, published in March 2005, was obviously derived from the 2002 version of the *National*

Security Strategy. The latest *National Military Strategy*, dated 2004, predates both the current *National Security Strategy* and the current *National Defense Strategy*. Presumably, both derivative documents will be revised to accommodate the 2006 *National Security Strategy*.

The *National Security Strategy* describes the President's high-level national security objectives. The current version contains the following nine goals:

- Champion aspirations for human dignity.
- Strengthen alliances to defeat global terrorism and work to prevent attacks against us and our friends.
- Work with others to defuse regional conflicts.
- Prevent our enemies from threatening us, our allies, and our friends with weapons of mass destruction.
- Ignite a new era of global economic growth through free markets and free trade.
- Expand the circle of development by opening societies and building the infrastructure of democracy.
- Develop agendas for cooperative action with the other main centers of global power.
- Transform America's national security institutions to meet the challenges and opportunities of the 21st century.
- Engage the opportunities and confront the challenges of globalization.

Appropriate to a nation's highest-level strategic document, the *National Security Strategy* focuses on describing desired ends rather than means. In addition to the nine national security goals the President hopes to achieve, the current *National Security Strategy* contains the President's overarching vision of the future national security environment, including its threats, challenges, and opportunities. The *National Security Strategy's* goals transcend purely defense or military-related objectives and include social and human rights goals that imply the application of economic and diplomatic means as well.

DoD's *National Defense Strategy* narrows its focus to the role of defense in establishing national security. It sets forth a set of strictly defense-related objectives derived from the President's *National Security Strategy*. The current *National Defense Strategy* offers four defense objectives:

- Secure the United States from direct attack.
- Secure strategic access and retain global freedom.
- Strengthen alliances and partnerships.
- Establish favorable security conditions.

Appropriate to a document intended to implement the higher-level *National Security Strategy*, the *National Defense Strategy* also offers the following means by which the defense objectives are to be achieved:

- Assure allies and friends.
- Dissuade potential adversaries.
- Deter aggression and counter coercion.
- Defeat adversaries.

While it remains to be seen how any new *National Defense Strategy* will change in light of the 2006 *National Security Strategy*, no obvious inconsistencies between the two documents are apparent, at least at the level of objectives and high-level means. Hence, even though it is somewhat out of date, the *National Defense Strategy* appears to remain a reasonable place to look for infrastructure implications.

The third document, the *National Military Strategy*, supports the *National Security Strategy* and provides implementation details for the *National Defense Strategy*. The *National Security Strategy* is long on ends; the *National Military Strategy* concentrates on means. Further, the *National Military Strategy* limits itself to purely military matters, a narrower construct than defense. Just as the *National Defense Strategy* is based on an earlier version of the *National Security Strategy*, the *National Military Strategy* precedes the current *National Defense Strategy*, but again appears to be fairly consistent with the more recent parent document and therefore a reasonable source of infrastructure implications.

The current *National Military Strategy* envisions a security environment characterized by three aspects: a wider range of adversaries, a more complex and distributed battlespace, and technology diffusion and access. The *National Military Strategy* alone among the three strategic documents begins to specify attributes of the required armed force. It lists the following seven:

- fully integrated
- expeditionary
- networked
- decentralized
- adaptable
- decision superiority
- lethality.

In addition, the *National Military Strategy* prescribes four capabilities the future force must have:

- applying force
- deploying and sustaining military capabilities
- securing battlespace
- achieving decision superiority.

None of the above ends and means from any of the three documents provides enough detail to translate into concrete implications for installations and stationing. Within the bodies of the documents, however, one finds statements about the future that do have broad stationing and infrastructure implications. These include a continuing need for deployment of forces; uncertainty about the timing, location, and purpose of deployments; rotation of forces to cover extended operations; a greater need for force protection and security; a need to sustain forces in distant, austere environments; participation in joint, interagency, and multinational operations; and provision of support to civilian authorities in national emergencies.

Because of its generally high level, the *National Security Strategy* deals with fewer of the implications than do the *National Defense Strategy* and the *National Military Strategy*. In fact, the 2006 version of the *National Security Strategy* deals with none of the seven. By contrast, the two lower-level documents, the *National Defense Strategy* and *National Military Strategy*, offer multiple references to most of the implications.

Implications of Strategic Documents for Army Infrastructure and Stationing Strategies

- **Shift in forward presence from well-established installations in Europe and Asia (GDPR)**
 - More forces based in U.S.
 - Rotations to more austere forward operating sites
- **Deployment and sustainment of forces (Army White Paper)**
 - Access to strategic lift
 - Connection to Global Information Grid
 - 24-hour reachback capability
- **Changes in Army structure and training**
 - Army Modular Force Plan
 - Army Force Generation Model

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The changes in the *National Security Strategy*, *National Defense Strategy*, and *National Military Strategy* since 2001 are reflected in other DoD and Army planning documents and initiatives that have more direct implications for infrastructure and stationing. These include the Global Defense Posture Review (GDPR), the Army white paper “Serving a Nation at War,” the Army Modular Force Plan, and the Army Force Generation Model (ARFORGEN).

The GDPR moves the 1st Armored Division and the 1st Infantry Division from Europe to the United States and replaces them with a Stryker Brigade Combat Team. A heavy brigade and support units will be moved from Korea to the United States. Forces that remain in Korea will be relocated away from the Seoul area into the central and southern sections of the country. The GDPR also envisions the creation of a network of Forward Operating Sites and Cooperative Security Locations to support the Global War on Terrorism and provide avenues of access for contingency operations.³ As a result, fewer

³ Forward Operating Sites are defined as expandable “warm facilities” maintained with a limited U.S. military support presence and possibly prepositioned equipment. They will support rotational rather than permanently stationed forces and be a focus for bilateral and regional training. Cooperative Security Locations will be facilities with little or no permanent presence, maintained with periodic service, contractor, or host nation

soldiers will be permanently stationed overseas with their families. Instead, they will rotate in and out of bases with less developed infrastructure for training exercises or for contingency deployments as threats develop.⁴

The Army white paper “Serving a Nation at War” (Department of the Army, 2004c) describes some of the changes the Army is undergoing to respond to the changes in national strategy. To support sustained deployed operations, the Army is developing more modular tactical organizations, establishing unit rotation cycles, and stabilizing the assignment of soldiers to units during rotation cycles. Specific implications for installations are requirements for access to strategic lift and improved connectivity to support en route mission planning and situational awareness, reachback operations, education, and communication with families.

Under the Army Modular Force Plan, the Army is reorganizing from a division-based to a brigade-based force. Brigades will be more self-sufficient and standardized as heavy Brigade Combat Teams (BCTs), infantry BCTs, or Stryker Brigade Combat Teams (SBCTs). Above brigade level, the force will be supported by modular Combat Aviation Brigades, Fires Brigades, Battlefield Surveillance Brigades, Combat Support Brigades (Maneuver Enhancement), and Sustainment Brigades. Original plans suggested that the number of active component combat brigades would increase from 33 to 43, with an additional 34 combat brigades in the National Guard. However, the 2006 *Quadrennial Defense Review* proposed 42 active component and 28 National Guard combat brigades. It also recommended 75 active component, 78 National Guard, and 58 Army Reserve support brigades.⁵

The Army Force Generation Model implements a cyclical approach to readiness and force availability and is intended to make deployments more predictable for commanders, soldiers, and their families. Under ARFORGEN, units will be placed in one of three force pools: a Reset/Train pool for units redeploying from long-term operations; a Ready pool for units assessed as “ready” to conduct mission preparation and training; and an Available pool for units assessed as “available” to conduct missions or serve as rapidly deployable contingency forces. Active component units will pass through the one-year window of the Available pool every three years, Army Reserve units every five years, and National Guard units every six years.⁶

The Army Modular Force Plan and ARFORGEN are together intended to provide the rotational forces needed to support extended operations overseas.

support. They will provide contingency access and be a focal point for security cooperation activities. (See Office of the Secretary of Defense (2004), pp. 10–11.)

⁴ Office of the Secretary of Defense (2004), Cahlink (2004), and Commission on Review of Overseas Military Facility Structure of the United States (2005).

⁵ Department of the Army (2005h), Office of the Secretary of Defense (2006), and Melnyk (2006).

⁶ Pullen (2005) and U.S. Army Forces Command (2005).

BRAC 05 Mandates Additional Changes to Army Infrastructure

- **BRAC 05 emphasized military transformation and joint warfighting capability**
 - Other goals included consolidation and efficiency, creation of Army and joint Centers of Excellence
- **Army proposals integrated changes due to Modularity and GDPR**
- **Seven Joint Cross-Service Groups also submitted proposals affecting the Army, such as**
 - Consolidation of Training Centers and Schools
 - Relocation of Major Command Headquarters
 - Movement of support activities out of Washington, D.C., area

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In addition to supporting initiatives arising from changes in national strategy, Army installations will be required to implement the recommendations of the 2005 Base Realignment and Closure Commission by 2011. Unlike previous BRAC rounds, the goal of achieving savings through eliminating excess capacity was not always the primary consideration for recommendations. The Secretary of Defense's planning guidance emphasized that the 2005 BRAC round should focus on supporting military transformation and implementing opportunities for greater joint activities among the services. Other goals included the consolidation of command headquarters on joint or multifunctional installations and creation of Army and joint Centers of Excellence for training and RDAT&E (research, development, acquisition, testing, and evaluation).

The Army's BRAC proposals integrated the stationing of new modular brigades as well as the return of overseas units mandated by GDPR. The Army also proposed a major reorganization of reserve component facilities, consolidating headquarters and other activities onto 125 new joint or multifunctional Armed Forces Reserve Centers.

Seven Joint Cross-Service Groups were created to analyze common business-oriented functions across the military departments and defense agencies. Their focus areas were education and training, headquarters and support activities, industrial, intelligence, medical, supply and storage, and technical. Their proposals competed on an equal footing

with proposals from the military services for DoD approval and funding. Several of the Joint Cross-Service Group proposals that were accepted by the BRAC Commission will affect the Army. These include

- consolidation of the Armor and Infantry Centers and Schools to create a Maneuver Center at Fort Benning, Georgia
- consolidation of the Air Defense and Field Artillery Centers and Schools to create a Net Fires Center at Fort Sill, Oklahoma
- consolidation of the Ordnance, Quartermaster, and Transportation Centers and Schools to create a Combat Service Support Center at Fort Lee, Virginia
- relocation of Headquarters, Forces Command, to Pope Air Force Base, North Carolina
- relocation of Headquarters, Training and Doctrine Command, to Fort Eustis, Virginia
- relocation of Army Materiel Command to Redstone Arsenal, Alabama.

In addition, many smaller headquarters and support activities are being moved out of leased office space in the Washington, D.C., area onto military installations, in part for security reasons. For example,

- The Army Test and Evaluation Command and the Army Evaluation Center are being moved to Aberdeen Proving Ground, Maryland.
- The Human Resources Command and other personnel commands are being consolidated at Fort Knox, Kentucky.
- The regional headquarters structures of the Installation Management Command, the Network Enterprise Technology Command, and the Army Contracting Command are being consolidated into Eastern and Western Region Commands at Fort Eustis, Virginia, and Fort Sam Houston, Texas.⁷

⁷ Defense Base Closure and Realignment Commission (2005) and Department of the Army (2005e).

Combined Effects of DoD and Army Initiatives Create Challenges

- **Army will move about 150,000 billets, most onto U.S. installations**
 - 25,000 billets move for new maneuver BCTs (FY04–06)
 - 26,000 moves associated with Support Brigades (FY06–11)
 - 60,000 moves in Institutional Army (offices, light industry, schoolhouses) due to BRAC
 - 48,500 moves associated with GDPR (FY05–11)
- **Military construction budgeted at \$4 billion for operational facilities**
 - Doesn't include community or Morale, Welfare, and Recreation facilities
- **Implications of more intensive use of training space**

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As a result of BRAC, GDPR, and the Army Modular Force Plan, the Army will be moving about 150,000 military and civilian positions over the next five to six years. Most of these positions will be moved onto U.S. installations from other U.S. installations, overseas installations, and leased office space. (See LaRocque, 2005.)

The establishment of new modular combat brigades, involving about 25,000 soldiers, should be completed by the end of FY06. Many of these units are being placed in temporary facilities while permanent facilities are being constructed. An additional 26,000 positions will be moved from FY06–11 to create modular support brigades (Combat Aviation, Fires, Battlefield Surveillance, Combat Support, and Sustainment). BRAC decisions affecting headquarters and support activities, laboratories and other light industrial facilities, and training centers and schools will result in the movement of about 60,000 positions, including civilian personnel. Legally, these moves must be completed within six years after the President transmits the BRAC report to Congress. The return of units from Europe and Korea under GDPR is expected to involve 48,500 soldiers and be completed by FY11.

The military construction funding needed to construct operational facilities, including barracks, motor pools, dining facilities, and company, battalion, and brigade headquarters, is estimated at over \$4 billion (LaRocque, 2005, p. 1). This does not include the community and morale, welfare, and recreation facilities, such as gymnasiums, child

development centers, child and youth service centers, and chapels, needed to support soldiers and their families. In addition to planning for individual facilities, installation master planners must also ensure that projects are sited within compatible/appropriate land use and understand the long-term planning implications of these decisions.

As the number of operational forces stationed on U.S. installations increases and ARFORGEN training cycles are implemented, existing training land and ranges will be used more intensively.

Examples of Planned Changes

Installation	<u>Modularity/GDPR/BRAC</u>		ARFORGEN
	Gains	Losses	
Ft Benning	Armor School		
Ft Bliss	4 BCTs & 1AD HQ Artillery brigade Aviation brigade	Air Defense Artillery (ADA) School & units	PGP Cluster HBCT Eqmt Set
Ft Carson	3 BCTs & 4ID HQ 10th Medical Group	3rd Armored Cavalry Regiment (ACR)	PGP HBCT Eqmt Set
Ft Hood	1 New BCT & 3rd ACR	2 BCTs & 4ID HQ Aviation, other units	PGP Cluster
Ft Knox	1 New BCT Eng, MP, CSS units Personnel functions	Armor School	PGP Cluster IBCT Eqmt Set
Ft Riley	1 BCT & 1ID HQ Aviation brigade CSS, other units	Engineering, other units	
Ft Sill	ADA School & units Army Reserve 95th Div	Artillery brigade	PGSP (Fires) CS Eqmt Set

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This table shows some examples of the units and activities being moved as a result of modularity, GDPR, and BRAC at Army installations with some of the biggest impacts. It also shows some training and mobilization functions being added as a result of ARFORGEN.⁸

Fort Benning, Georgia, will gain the Armor Center and School, which will be consolidated with the Infantry Center and School to create a Maneuver Center of Excellence for ground forces' training and doctrine development. Fort Benning will have a net gain of about 10,000 personnel.

Fort Bliss, Texas, will be transformed from an institutional training installation into a major mounted maneuver training installation, with a net gain of over 18,000 personnel. It will lose the Air Defense Artillery (ADA) Center and School and some air defense artillery units, and will gain four BCTs and the 1st Armored Division (1AD) headquarters, along with an artillery (fires) brigade and an aviation brigade. Fort Bliss will also become a Power

⁸ Sources: U.S. Army Forces Command (2005), LaRocque (2005), and Department of the Army, Base Realignment and Closure Division (2005a–g).

Generation Platform (PGP) with clustered capabilities at Fort Hood, Texas, and house a Heavy Brigade Combat Team (HBCT) equipment set for reserve component training.⁹

Fort Carson, Colorado, will gain three BCTs and become the home of the 4th Infantry Division (4ID) headquarters, but will lose the 3rd Armored Cavalry Regiment (ACR). It will also gain the inpatient mission of the 10th Medical Group from the U.S. Air Force Academy. Fort Carson will become a Power Generation Platform (PGP) with a HBCT equipment set. It will have a net gain of almost 10,000 personnel.

Fort Hood gains one new BCT under the Army Modular Force plan, as well as the 3rd ACR, but loses two BCTs and 4ID headquarters to Fort Carson and maneuver battalions, a support battalion, and aviation units to Fort Bliss. Nevertheless, it will have a net gain of over 6,000 personnel. Fort Hood will become part of a PGP cluster capability with Fort Bliss.

Fort Knox, Kentucky, will lose the Armor Center and School to Fort Benning but will gain a new infantry brigade combat team; engineer, military police, and combat service support units from Europe and Korea; and a reserve regional training center, for a net gain of about 1,500 personnel. Fort Knox will be a PGP with clustered capabilities at Fort Campbell, Kentucky, and will house an infantry brigade combat team (IBCT) equipment set.

Fort Riley, Kansas, gains one new BCT under the Army Modular Force plan, as well as the 1st Infantry Division (1ID) headquarters, aviation, Combat Service Support (CSS), and other units from Europe. However, it will lose an engineer brigade headquarters, two other engineer units, two maneuver battalions, and other smaller units. Fort Riley will have a net gain of about 9,000 personnel.

Fort Sill, Oklahoma, will gain the Air Defense Artillery Center and School, which will be combined with the Field Artillery Center and School to form a Net Fires Center. It will also gain some air defense artillery units and the Army Reserve's 95th Division (Institutional Training) and lose an artillery brigade. The net effect will be a gain of about 3,000 personnel. Fort Sill will become a Power Generation Support Platform (PGSP) for reserve component fires brigades, with an associated combat support (CS) equipment set.¹⁰

⁹ U.S. Army Forces Command (2005) defines a PGP as an installation "providing AC/RC power projection, combat preparation, and sustainment capabilities. PGPs can provide the life support, training, maintenance and deployment infrastructure to support an additive BCT . . . and its training set(s) of equipment. PGPs can support deployment/redeployment operations with proximate rail and air facilities that meet throughput requirements. The PGP is capable of hosting Combat Training Center Exportable Training Capabilities with associated infrastructure."

¹⁰ U.S. Army Forces Command (2005) defines PGSPs as "installations that also provide power projection, mission preparation, and sustainment capabilities like PGPs, but are focused on CS and CSS units. The capacity is up to Support Brigade size with corresponding training equipment sets. Capable of hosting Bde [brigade] level collective unit training for specific CS or CSS Support Bdes."

Army Modernization Plan Includes Implications for Training and Facilities

- **Increasing need for Live-Virtual-Constructive training capabilities**
 - Provide realistic simulations
 - Link training institutions, home station, combat training centers, and deployed units
- **Increasing importance of home station training**
- **Three essential tasks for installations:**
 - Become deployment platforms with robust, technology-rich reach capabilities
 - Adjust support and resourcing priorities to meet Army's transformation and deployment needs
 - Maintain support for well-being of soldiers and their families

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The 2005 *Army Modernization Plan* (Department of the Army, 2005a) describes how the Army will transform itself from the Current Force to the Future Force within the context of the Army's changing operational environment. The Army Modular Force Plan and ARFORGEN initiatives (as well as GDPR and BRAC) will have significant implications for the Army's training and facilities. The *Army Modernization Plan* addresses some of these implications (in addition to describing impacts on Army doctrine, organization, materiel, and personnel).

With respect to training, one aspect emphasized by the *Army Modernization Plan* is the importance of having integrated and networked Live-Virtual-Constructive training capabilities. Live-Virtual-Constructive training, which incorporates technology enabling realistic simulations, involves links between training institutions, home stations, combat training centers, and deployed units. These links provide units ready access to knowledge and training opportunities that help them to sustain operational readiness wherever they are stationed or deployed.

The usefulness of Live-Virtual-Constructive training capabilities becomes especially clear when considering the increasing importance of home station training. Here, home station refers to installations, Army National Guard armories, and Reserve centers. The

“reset/train-ready-available” operational cycle envisioned by ARFORGEN means that forces will likely be unable to train at combat training centers prior to deployment. Instead, units in the “available” pool will have to be prepared to deploy from their home stations. Live-Virtual-Constructive training will help to move the Army from “place- and time-based learning strategies to a strategy that pushes training to the soldier any place and time that it is needed” (Department of the Army, 2005a, p. C-9). The stated goal is for units to be able to train at home station to a standard and fidelity similar to a combat training center.

With respect to facilities, the *Army Modernization Plan* also describes how installations must adapt to support the soldier in light of the ongoing changes in force structure and technology. Specifically, the *Army Modernization Plan* mentions three essential tasks that must be accomplished for installations to meet their evolving role. First, strategies must be developed to posture installations as deployment platforms with robust, technology-rich reach capabilities. This is to enable installations to provide soldiers “continuous support from the foxhole to home station throughout deployment” (Department of the Army, 2005a, p. F-1). Second, installation support and resourcing priorities must be adjusted in tandem with the evolving Army. And third, support for the well-being of all soldiers and their families must be maintained. The *Army Modernization Plan* notes that the Office of the Assistant Chief of Staff for Installation Management is taking the lead on developing objectives and strategies under these three tasks.

Introduction of New Systems Likely to Require Additional Training Space & Facilities

- **Future Combat System (FCS)**

- FCS Evaluation BCT to be activated in FY07 at Fort Bliss
- Technology spin-outs planned for FY08, FY10, FY12, FY14
- Initial Operating Capability of first FCS-equipped BCT planned in FY15

- **Unmanned Aerial Vehicle (UAV) systems**

- Currently procuring Shadow and Raven systems
- Planning to procure Small UAV and Extended Range Multi-purpose UAV
- Future aviation forces, including UAV units, will require simulation devices for individual and collective training

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New demands on infrastructure will also arise from weapon systems that are scheduled to be fielded over the next decade and beyond. The introduction of new technologies, such as those associated with the Future Combat System (FCS) and Unmanned Aerial Vehicle (UAV) systems, into Army forces will change the way the Army trains and fights and will likely require additional training space and facilities.

FCS is intended to be the centerpiece of the Army's Future Forces. It is a family of 18 advanced, networked platforms that includes both manned and unmanned air- and ground-based maneuver systems, maneuver support systems, and sustainment systems. As indicated by the *Army Modernization Plan*, FCS is not planned to be fielded all at once; instead, the Army is pursuing a "spin-out" strategy whereby promising FCS technologies and capabilities are identified, refined, and then inserted into Current Force units according to a set schedule. The Army anticipates having four technology spin-outs in FY08, FY10, FY12, and FY14 and will establish an Evaluation BCT at Fort Bliss in FY07 to test and experiment with these FCS technologies (Department of the Army, 2005b, and Tice, 2006). The Initial Operating Capability of the first FCS-equipped BCT is planned for 2014.¹¹

¹¹ However, FCS has faced difficulties with projected cost growth, schedule slippage, reliance on immature technologies, and criticism of its contracting structure. See, for example, Donnelly (2006) and Holmes (2007).

Incorporation of FCS would likely increase the requirements for training ranges, particularly because of its large battlefield footprint. By one estimate, FCS is expected to have a doctrinal battlefield footprint of 17,671 square kilometers (an area encompassing a 75-kilometer radius). This compares to the current doctrinal footprint of 1,600 square kilometers (a space encompassing 40 x 40 kilometers) for an SBCT (Knott and Natoli, 2004, p. 12). The larger FCS footprint might mean that installations need to acquire additional land for training ranges to accommodate Future Forces and/or increase the throughput at the largest existing ranges.

UAVs will also become a more prominent part of Army forces. The Army expects to field a Brigade Aviation Element in every BCT to coordinate with Combat Aviation Brigades and provide BCT commanders with the full range of aviation assets for their missions. The Army will also collocate U.S.-based Combat Aviation Brigades at installations with two or more BCTs to enhance air/ground integration training (Department of the Army, 2005g, pp. D-4–D-5). UAVs currently employed by the Army include

- **Shadow 200**, a tactical system designed to provide reconnaissance, surveillance, and target acquisition as well as battle damage assessment to ground commanders
- **Raven**, a small reconnaissance, surveillance, and target acquisition system intended to aid small units
- **Hunter**, an older reconnaissance, surveillance, and target acquisition and battle damage assessment system that provides intelligence and attack capabilities (using the Viper Strike munition) at ranges up to 200 kilometers (Department of the Army, 2005a, pp. D-10–D-11).

The Army anticipates acquiring a new, Small Unmanned Aerial Vehicle that is rucksack-portable and that can provide enhanced reconnaissance, surveillance, and target acquisition capabilities for small units. This system would complement the Raven. The Army will also acquire a new Extended Range Multi-purpose UAV—called the Warrior—to replace the Hunter system. The Warrior will provide corps headquarters and below with intelligence collection; reconnaissance, surveillance, and target acquisition; attack; and Command, Control, Communications, and Intelligence capabilities (Department of the Army, 2005g, p. D-11).

To ensure that UAV units become effectively integrated with ground activities, future aviation forces will likely require simulation devices to enhance individual and collective training. Moreover, the added reliance on UAVs will increase the demands placed on the frequency spectrum in and around installations. Installations might need to undertake special efforts to minimize the potential for interference with other defense and commercial systems.

The *Army Modernization Plan* and the *Army Science and Technology Master Plan* (Department of the Army, 2005f) do not contain any specific information on training land, facilities, simulation devices, or other training resources required by new systems. More

detailed information may be available in other sources, such as the Operational Requirements Documents or contract specifications for individual systems.

Homeland Security Strategic Plans May Have Additional Implications for Army Infrastructure

- **Homeland Security encompasses protection from all hazards (e.g., terrorist attacks, natural disasters, industrial accidents)**
 - DoD supports Homeland Security through Homeland Defense and Defense Support of Civil Authorities (DSCA)
 - DoD is the lead agency for Homeland Defense, i.e., protection against external threats
 - DoD supports other agencies in DSCA missions, such as responding to terrorist attacks or other domestic emergencies
- **Some infrastructure and stationing implications overlap with the National Defense and Military Strategies**
 - Forward presence, information infrastructure
- **Other implications receive additional emphasis**
 - Force protection, mission assurance, training requirements for dual-capable forces to respond to DSCA missions
- **Recent missions include Hurricane Katrina, border security initiative, response to potential anthrax incidents**

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The increased national emphasis on homeland security may have implications for Army infrastructure. Because the national approach to homeland security has been evolving rapidly since the attacks of September 11, 2001, Army and joint strategic plans might not capture some national expectations for DoD and Army infrastructure. To explore this issue, the study team reviewed key Department of Homeland Security and DoD homeland security guidance documents to assess their implications.

Homeland security involves a broad set of issues, some of which overlap with DoD responsibilities, particularly homeland defense, force protection, and mission assurance. Homeland security initially focused on terrorism, but has been broadened to address all hazards (natural disasters, industrial accidents, etc.) and includes capabilities to prevent, prepare for, respond to, and recover from incidents. As such, it entails key operational concepts such as preparedness, protection (of infrastructure, borders, or transportation), first response and emergency response, incident management, and disaster recovery.

Within the concept of homeland security, DoD is responsible for the homeland defense mission, which is defined as the protection of U.S. sovereignty, territory, domestic population, and critical infrastructure against external threats from the air, land, or sea by foreign militaries or by foreign terrorist organizations (Chairman of the Joint Chiefs of Staff, 2004). DoD also supports other federal agencies and state and local entities in response to

homeland security incidents such as internal terrorist attacks, hurricanes, industrial accidents, or transportation system disasters.

For the most part, DoD's homeland security responsibilities overlap with the objectives of the *National Defense Strategy* and the *National Military Strategy*, but there are some differences in emphasis, and there may be some additional implications for Army installations in the areas of force protection, mission assurance, and training requirements for dual-mission forces expected to support civil authorities, particularly for chemical, biological, radiological, nuclear, or high-yield explosive terrorist incidents or for natural disasters and accidents that are of such scope and nature to require DoD resources or expertise.¹²

The Army and DoD have recently been involved in two major Defense Support to Civil Authorities missions—the response to Hurricane Katrina and the border security initiative—as well as the response to potential anthrax incidents in Washington, D.C. These cases illustrate some of the issues involved in homeland security.

Hurricane Katrina. Because of the magnitude of the disaster, both National Guard and active-duty forces were called to support the civilian response to Hurricane Katrina. Changes resulting from this experience include the collocation of a Joint Task Force command element with the Principal Federal Official for an incident (U.S. Department of Homeland Security, 2006b, p. 2). One criticism of the response that is still being resolved was the length of time it took for military forces to arrive. Proposals to improve the speed of response include making all National Guard units capable of rapid deployment, dedicating more National Guard units to homeland security missions and having them train with civilian organizations, or designating National Guard and active units in the ARFORGEN “available” pool for homeland security missions.¹³

Border Security. The Secretary of Homeland Security announced new border security initiatives in May 2006. The Department of Homeland Security expected to hire 6,000 additional border patrol agents by the end of 2008. In the meantime, the President asked state governors to provide up to 6,000 National Guard personnel to assist the border patrol. While not directly involved in law enforcement activities, they will provide support and assistance by operating surveillance systems, analyzing intelligence, installing fences and vehicle barriers, building patrol roads, and providing training. This deployment is expected to last up to two years, although it may be reduced in the second year as new border patrol agents are hired and trained. As of October 2006, about 5,200 National Guard troops were stationed along the U.S. southern border.¹⁴

Potential Anthrax Incidents in Washington, D.C. During March 14–18, 2005, three incidents that were initially suspected of involving anthrax occurred in the Washington,

¹² A detailed description of homeland security strategies, presidential directives, and plans and their implications for Army infrastructure is included in Appendix A.

¹³ See Davis et al. (2007) for a description of the Army's response to Hurricane Katrina.

¹⁴ See U.S. Department of Homeland Security (2006c), White House, Office of the Press Secretary (2006), and McCombs (2006).

D.C., area. While the incidents ultimately proved to be both unrelated and detection errors, the management of these incidents highlighted issues associated with DoD responses that require the involvement of other homeland security partners. Although incident command activities were conducted according to the concepts specified in the Department of Homeland Security's *National Incident Management System* and its *National Response Plan*, it is not clear that coordination with national-level entities was performed according to a plan that was compliant with the *National Response Plan*. This resulted in ad hoc responses with attendant problems relating to coordination of health responses, public communications, care for the workforce, and concern for the public.¹⁵

¹⁵ See Kelly et al. (2006).

3. Mapping to Installation Strategic Plans

Outline

- **Implications of DoD and Army strategic plans and initiatives**
- **Mapping to installation strategic plans**
- **Issues for infrastructure planning**
- **Data collection and metrics**

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In this section, we review the major themes of DoD- and Army-level installation strategic plans and compare them with the implications for Army infrastructure that we identified in the Army and joint strategic plans and initiatives. We seek to determine which strategic themes and issues the Army infrastructure community is currently addressing and to identify where gaps remain.

Documents reviewed in this section include

- *Defense Installations Strategic Plan*
- *Army Installation Strategic Plan*
- *Army Strategy for the Environment*
- *Installation Sustainability Plans*

Themes Implied by DoD and Army Installation Strategic Plans

- **Linked to strategic documents**

- More joint operations and coordination
- Antiterrorism/force protection concerns
- Quality of facilities and services, including housing and community facilities

- **Unique to installation strategic plans***

- Sustainability and sound natural resource management
- Managing assets on a limited budget
- Adherence to common DoD standards and metrics
- Greater collaboration and concerns outside the fence-line

*May be linked to DoD or other government strategic management documents

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We reviewed the *Defense Installations Strategic Plan* (U.S. Department of Defense, 2004) and the *Army Installation Strategic Plan* (Department of the Army, 2005c). These two documents are fairly consistent in the goals, objectives, and themes that they present for military installation planning.

These documents echo three strategic themes that we identified in the other strategic documents. First, they discuss the implications of more joint service operations and coordination, including the joint use of physical assets and joint warfighting needs. Second, the documents discuss antiterrorism and force protection concerns. For example, they emphasize the need to protect installation assets from terrorist and criminal threats, a need for quick reaction capability, and an increased focus on force protection construction, security, and restricted access issues.¹⁶ Finding a balance between security concerns and installation access has become more difficult since 9/11 and it is a particular challenge for Army installations, which have had a history of allowing significant public access. Third, these documents pay significant attention to quality of life and recognize that such factors become more important to recruiting and retaining an all-volunteer force when there is ongoing conflict. The DoD *Defense Installations Strategic Plan* states, “Supporting the

¹⁶ See Department of the Army (2005c), pp. 14–15.

warfighter requires . . . a safe, secure and productive workplace, a healthy environment, and good living conditions for our members and their families” (U.S. Department of Defense, 2004, p. 8). Both documents discuss the need to improve the quality of base facilities; to provide quality housing, schools, medical care, morale, welfare and recreation facilities, and even natural resources; and to reduce accidents, injuries, and occupational illnesses.

These two documents also emphasize four strategic themes that we did not find in the strategic documents reviewed in the previous section. However, such issues may appear in DoD, Army, or other government documents, such as management and functional strategic plans.

First, the installation strategic plans recognize that land, air, and water are finite resources with a long-term trend toward more public expectations and pressures, which has and will continue to affect installations. To maintain operational flexibility for training and other installation operations, the Army needs to better manage and sustain natural resources. The documents stress sustainability and “sound environmental stewardship” (U.S. Department of Defense, 2004, p. 4) to address pressures from encroachment, to maximize access to land for training, to comply with natural resource conservation laws, to conserve natural resources held in public trust, and to help promote soldier and family quality of life. This strategic theme is also addressed in *The Army Strategy for the Environment* (Department of the Army, 2004e). Although environmental issues are not mentioned in the DoD, Army, and Department of Homeland Security strategic documents reviewed in the previous section, they must be addressed strategically by the installation management community, because they can affect the Army’s long-term ability to use its infrastructure to meet training and operational needs.

Second, they stress the need to manage assets on a limited budget. In the past, the Army has tended to budget less than the identified requirements for facility sustainment and base operations and to allow funds to “migrate” to other purposes. As a result, some facilities have deteriorated prematurely and may have a shortened service life. To reduce lifecycle facility costs, installations must have adequate budgets to perform routine maintenance and set priorities to recapitalize deteriorating facilities.

Third, a related theme is the emphasis on common installation definitions, standards, and metrics. For example, DoD has developed a Facilities Sustainment Model based on commercial benchmarks as a common budget forecasting tool to be used by all the services. It has also developed a common rating system (Q ratings) to assess the condition of facilities, as well as other standardized information systems and metrics.¹⁷

Fourth, these documents recognize the importance of more collaboration and interaction with organizations outside the installation fence-line. Installations are no longer isolated military communities. Given local community and regional growth (including suburban and rural sprawl), public expectations, and outsourcing trends, there is a greater need to look at the relationships with surrounding communities and others, such as industry,

¹⁷ The Army is transitioning to Q ratings from its current C ratings system (Department of the Army, 2005c, p. 12).

to address installation management concerns and needs. Interactions with other organizations because of diverse issues such as environmental and encroachment concerns, antiterrorism, and business reasons will continue to increase. Creative collaboration with others to address installation challenges, such as encroachment, will become more important. Specifically, these documents stress issues of encroachment by local community growth, coordinating with the surrounding local community, competition for fixed and controlled assets (airspace, radio frequency spectrum, environmental permit limits),¹⁸ and outsourcing, i.e., privatizing facilities and services.

¹⁸ U.S. Department of Defense (2004), p. 5.

DoD and Army Installation Strategic Plans Aren't Truly "Strategic"

- **Defense and Army Installation Strategic Plans focus on current problems and known changes over the FY06–11 POM**
- **Not clear how goals will be met within planned budgets**
 - **Examples from Army Installation Strategic Plan:**

- **Goal: Station the active component modular units (includes constructing required facilities and reconfiguring training lands/ranges)**
- **Benchmark: Station the active component modular units by FY11**
- **Performance Metric: All units converted to modular force structure are provided adequate facility and training land/range support**

- **Goal: Transfer 3,713 BRAC acres**
- **Benchmark: Achieve 90% of funded disposal of excess facility goals per FY across the POM**
- **Performance Metric: Percentage of total BRAC excess acreage disposed**

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In many ways, the *Defense Installations Strategic Plan* and the *Army Installation Strategic Plan* are not truly strategic. They tend to focus on current problems and known changes over the FY06–11 Program Objective Memorandum (POM), such as building facilities needed to accommodate changes in stationing due to the Army Modular Force Plan, GDPR, and BRAC. There are plans to update the DoD and Army installation strategic plans every few years. However, the plans do not address the potential for long-term changes over the next 10, 20, or 25 years.

It is also unclear how installations will be able meet the goals outlined in the plans within currently planned budgets. This chart shows two examples of goals, benchmarks, and performance metrics from the *Army Installation Strategic Plan*. The benchmarks and metrics tend simply to rephrase the goals and do not identify any intermediate steps that must be taken, problems that must be overcome, or resources that will be needed to achieve the goals.

Installation Sustainability Plans Take a More Strategic Approach at Local Level

- **Some installations are developing plans to improve sustainability by**
 - **Addressing interrelationships of mission, community, and the environment**
 - **Setting long-term goals and objectives over a 20–25 year horizon**
 - **Diverse involvement across the installation community**
- **Limitations to current plans**
 - **Mostly focused on environmental issues; not yet addressing many quality-of-life or master planning issues**
 - **Inconsistency in focus and scope**
 - **No higher level guidance or analysis looking at needs and synergies across installations**

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In addition to the DoD- and Army-level installation strategic plans, we found some long-term strategic planning activities being conducted at the local (installation) level and the Installation Management Command regional level. Several installations, including Fort Benning, Fort Carson, Fort Lewis, and Fort Bragg, have developed “installation sustainability plans.” An installation sustainability plan documents a strategic planning process for individual installations that focuses on creating sustainable, enduring installations by addressing mission, community, and environmental issues. For the last few years, these pilot installations have served as “test beds” for Army best practices on sustainability. Successes and lessons learned from these installations served as the foundation of the goals in *The Army Strategy for the Environment* (Department of the Army, 2004e). Currently, installation sustainability plans build on this strategy document and business, civil, and international sustainability activities and processes.¹⁹

The term “sustainability” is often defined uniquely by each community or organization based on its own interests, needs, and culture. Most sustainability plans focus on long-term, integrated systems approaches, healthy communities, and quality-of-life issues

¹⁹ Installations may also have an installation strategic plan developed by their Plans, Analysis, and Integration Office. Some installations integrate their installation sustainability plan with their installation strategic plan.

by addressing economic, environmental, and social issues. The concept recognizes that these issues are interdependent and integrated. Similarly, when an installation develops a sustainability plan, a team from the installation, working under the guidance of the commander and in coordination with regional stakeholders, defines their vision and goals for the installation over a 20- to 25-year horizon and addresses mission (the Army's equivalent to the economy), community (i.e., social), and environmental issues. Then the team identifies tasks needed to achieve the vision and goals and works on implementing them.

So far, most installation sustainability plans have focused mainly on environmental issues and are not addressing quality-of-life or master planning issues as thoroughly. For example, Fort Lewis has set goals to "Reduce air pollutants from training without a reduction in training activity" and for "Zero discharge of wastewaters to Puget Sound by 2025" (Fort Lewis, 2007). There is also inconsistency in the focus and scope of the plans from installation to installation. In March 2006, Installation Management Command's Southeast Region released an informal guide on installation sustainability planning in order to provide tools to other installations that may wish to initiate similar processes. The purpose of this guide is mainly to explain how to develop a sustainability plan and educate participants about sustainability processes. There is no clear guidance about what specific issues should be included in the plans. Obviously, installations' needs will vary, but there is the potential to address a common set of key issues, such as quality-of-life improvements and master planning needs, by taking a more strategic approach to providing guidance for these plans. Installations might benefit from a more formal Headquarters, Department of the Army (HQDA), policy requiring installation sustainability planning and guidance on conducting the planning process, including identification of common needs and potential synergies across installations.

DoD and Army Strategic Issues Not Fully Addressed by Installation Strategic Plans

- **How will installations accommodate coming changes in stationing?**
 - Guidance and decisionmaking authority for siting new facilities within appropriate land use and long-term planning impacts
 - Maintaining quality of life for soldiers and families
 - Management of new Forward Operating Sites and Cooperative Security Locations
 - **How will installations support more frequent deployments?**
 - Access to strategic lift (airports, seaports, intermodal links from installations to ports)
 - Loading/unloading capability
 - Connectivity to Global Information Grid and 24-hour reachback capability
- RAND – Family support facilities/services

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Several of the installation-related issues we identified in DoD and Army strategic documents were not fully addressed by the *Defense Installations Strategic Plan* or the *Army Installation Strategic Plan*. For example, we did not find much detail on how installations should accommodate the changes in stationing of Army units and other activities that are expected as a result of the Army Modular Force Plan, GDPR, and BRAC. The *Army Installation Strategic Plan* mentions some of the actions that will need to be taken in Objective 1.1,²⁰ but there was little guidance on how to site new facilities so they do not interfere with existing land uses or limit potential future land uses. Installations that are receiving large numbers of new personnel will also need to ensure that facilities are available to maintain the quality of life of soldiers and their families who are being relocated. Objective 1.2²¹ discusses some of the consolidations of overseas bases that will need to occur under GDPR and the need to establish Forward Operating Sites, but provides no guidance on what facilities are needed or how they will be managed.

²⁰ Reshape the overall structure of installations within the United States to better match current and future missions with joint warfighting needs (Department of the Army 2005c, p. 5).

²¹ Reshape the structure of installations abroad to better align with emerging threats (Department of the Army, 2005c, p. 6)

Another issue that receives little attention in the DoD- and Army-level installation strategic plans is the need to support more frequent deployments. DoD and Army strategic documents suggest that deployments will continue at the current pace. Rotations to Forward Operating Sites and Cooperative Security Locations may place additional demands on deployment infrastructure. Installations will need to have sufficient capacity to load and unload passengers and equipment and transport them to air and sea ports of debarkation. Installations are also expected to provide 24-hour reachback capability to deployed units through connectivity to the Global Information Grid. The high pace of deployments may put additional strains on soldiers and their families and increase demands for support services. Deployment infrastructure is discussed only briefly under Objective 1.1, where one of the goals is to “improve and modernize mobilization/deployment facilities as required,” but no additional detail is provided.

Training Implications Not Fully Addressed by Installation Strategic Plans

- **What are implications of new technology for training space and facilities?**
 - **More dispersed operations based on FCS and UAVs**
 - **Need for simulation facilities and links between training institutions, home stations, combat training centers, and deployed units**
- **How will installations support more joint training?**
 - **Often, large Air Force and Navy installations (e.g., Eglin Air Force Base) allow only overflight, not ground maneuver**
 - **DoD may have to rely on Army, Marine Corps installations to provide training space**

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Nor do DoD- and Army-level installation strategic plans fully address two issues raised by DoD and Army strategic initiatives regarding future infrastructure needs for training. First, what are the implications of new technology for training space and facilities? And second, how will installations support more joint training? These are discussed in turn.

Both the 2004 *Defense Installations Strategic Plan* and the *Army Installation Strategic Plan* rightly discuss the need to properly manage land, water, and air space resources to preserve range and operational capabilities (Objective 1.3); the need to improve land-use compatibility to satisfy training and readiness requirements (Objective 1.4); and the need to eliminate existing space or capacity deficits to reduce ineffective and expensive work-around conditions (Objective 1.6). However, these plans essentially take a static perspective of training demands because they do not examine how the introduction of new technologies will affect the types of training infrastructure required over time or the capacity of training infrastructure. For example, the inclusion of FCS technologies and the increased use of UAVs will result in more dispersed, networked operations. They could require larger maneuver areas and a higher number of dedicated communication frequencies than exist today.

Moreover, the strategic DoD and Army documents we reviewed described the increasing need for realistic simulation facilities and links between training institutions,

home stations, combat training centers, and deployed units. As mentioned, a major reason for these technologies is to help push training out to the soldier wherever and whenever it is needed. The 2004 *Defense Installations Strategic Plan* and the *Army Installation Strategic Plan* discuss reshaping the overall structure of U.S. installations to better match current and future missions with joint warfighting needs (Objective 1.1) and reshaping the structure of installations abroad to better align with emerging threats (Objective 1.2). But neither directly addresses how installations plan to acquire and incorporate these technologies to improve training.

Neither do these installation strategic plans discuss how to address joint training under Objective 1.1 (better matching of current and future mission with joint warfighting needs). Often the larger U.S. Air Force and Navy installations allow overflight but not ground maneuver, for environmental and other reasons. Ground maneuver, especially with tanks and other heavy equipment, is very destructive to the land and ecosystems. It results in higher maintenance and environmental costs and additional operational safety concerns. Many of these installations have to deal with threatened and endangered species issues, as well as other environmental concerns, that could affect their operations. Installation managers do not want to create any additional pressures on the ground that might jeopardize their own training and other installation operations.

For example, consider Eglin Air Force Base, which currently allows some specialized Army Ranger training involving foot soldiers, but no heavy equipment. The base consists of about 464,000 acres in the Florida panhandle, of which about 78 percent is a sandhill matrix ecosystem with prime habitat of old-growth stands of longleaf pine. The base's property harbors more than half of the remaining old-growth stands of longleaf pine (only 3 percent remains in the southeast U.S.). The fire-evolved longleaf pine systems at Eglin Air Force Base have great significance, containing many endangered, threatened, rare, and important species, such as the Red Cockaded Woodpecker and Florida bog frog (Hardesty et al., 1997). In fact, 11 federally listed threatened and endangered species are being actively managed on Eglin Air Force Base because they occur there either year-round or seasonally (Eglin Air Force Base, 2002, p. 57). Eglin Air Force Base staff have a well-developed program to manage such ecosystems so that there is minimal interference to their operations caused by the presence of threatened and endangered species. In addition, their environmental efforts have created a very good working relationship with the state and local environmental regulators, as well as the public. They are actively using their land for a variety of Air Combat Command testing and training purposes and would not want to jeopardize this activity with intensive ground training involving tanks or other heavy equipment.

Most other Air Force and Navy installations face similar problems. Installation staffs are already intensively using and managing installation lands for their own purposes and facing significant environmental pressures. Because of such issues, DoD may need to rely on

Army and Marine Corps installations, which already permit ground maneuver, to provide joint training spaces.²²

²² If DoD issued strong requirements for joint training and an in-depth assessment of cross-service land use and management were made, the other services might be persuaded to change their minds. However, such a policy change would require a cultural change and significant political capital.

Additional Implications of a 10-20 Year Time Horizon

- **Modularity, ARFORGEN, GDPR, and BRAC are issues for the next 5–10 years**
- **Over a longer time horizon, hedging against uncertainty and risk become more important**
 - **What are critical assumptions underlying current strategies and initiatives?**
 - **How might strategic context change over next 20 years?**
 - **Have installations retained enough of the right capacities to hedge against risks?**
 - **What might affect demand or supply?**
 - **For example, increased force structure, encroachment, natural disaster, or nuclear, biological, or chemical contamination**
- **Strategy can change more quickly than infrastructure**
 - **Some infrastructure decisions could be difficult to reverse**

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Changes associated with modularity, ARFORGEN, GDPR, and BRAC are scheduled to be completed in the next five to ten years. During the next few years, these initiatives may continue to evolve and mature, as do all nascent policies. More importantly, though, DoD and the Army will necessarily have to adapt their strategies and policies to unforeseeable changes in international and domestic conditions over the next 20 years. Hence, it is important for the Army to think hard about the assumptions that underpin these key policies and the ways those assumptions may be vulnerable. Such an analysis can help identify hedging actions that will permit the Army to deal with such changes should they occur, by ensuring that installations retain enough of the needed capacities to respond to changes in conditions. For example, the Army should consider what changes could affect either the demand for infrastructure or its supply, such as an increase in force structure or the loss of significant training areas because of encroachment, hurricanes or other natural disasters, or contamination by weapons of mass destruction.

Strategy can change more quickly than can infrastructure. Some infrastructure decisions, particularly those associated with BRAC, are indeed irreversible. Hence, it is of the utmost importance for the Army to deal now with futures that are plausible but inconsistent with the assumptions underlying current strategic documents.

4. Issues for Infrastructure Planning

Outline

- Implications of DoD and Army strategic plans and initiatives
- Mapping to installation strategic plans
- **Issues for infrastructure planning**
- Data collection and metrics

In the previous sections, we identified Army and joint strategic themes that will affect the Army infrastructure community over the next ten to twenty years and examined whether these issues are adequately addressed by DoD- and Army-level installation strategic plans. In this section, we identify some areas that should be included in infrastructure planning to help the Army ensure that its installations will meet emerging and future strategic needs. The first two slides discuss themes derived from DoD and Army strategic documents and initiatives. The third discusses strategic installation sustainability themes that affect the long-term viability of installations.

Assessment of Deployment and Training Needs and Long-Term Risks

- **Identify implications of modularity, ARFORGEN, and GDPR on infrastructure needed to support deployments**
- **Assess current and future training capacity and need for additional training land/ranges**
 - To accommodate changes due to modularity, ARFORGEN, GDPR, and BRAC
 - To support more joint training
 - To address implications of new technology, such as FCS
- **Analyze long-term infrastructure risks and uncertainties that the Army or DoD should hedge against**

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Several DoD and Army strategic initiatives, including GDPR, modularity, and ARFORGEN, as well as the need to rotate forces to support extended engagements such as Operation Iraqi Freedom, are likely to affect the Army's use of its deployment infrastructure. This suggests a need for a comprehensive assessment of expected peacetime and contingency demands for deployment infrastructure, the adequacy of the Army's current infrastructure, and enhancements needed to meet these demands. We define deployment infrastructure broadly to include facilities needed for the physical movement of troops and equipment, 24-hour reachback capability to support deployed units, and supporting the families of deployed soldiers.

A second area that should be addressed by strategic infrastructure planning efforts involves assessing the Army's current training capacity given its existing infrastructure, its future training capacity needs in light of anticipated changes, and whether additional training land and ranges will be required. The strategic documents reviewed showed that many current DoD and Army initiatives will significantly increase the demand for training infrastructure over time, including maneuver area, ranges, air space, frequency spectrum, and associated facilities and services. Modularization and ARFORGEN, for example, will increase the competition for maneuver areas and ranges (and their support services) by adding BCTs to both the active and reserve components. GDPR and BRAC will concentrate

forces onto fewer installations. The QDR and *National Military Strategy* emphasize the importance of more joint operations and training relative to the status quo. And FCS is planned to introduce new technologies, such as UAVs and armed robotic vehicles, that will require new types of training capabilities and capacities. This assessment would help to identify gaps in the Army's evolving training infrastructure.

A third strategic issue is identifying long-term risks and uncertainties that could affect the Army's demand for or supply of infrastructure and developing strategies to mitigate or hedge against these risks. One potential approach to analyzing long-term risks is a methodology developed at RAND called "assumption-based planning" (Dewar, 2002). This methodology entails examining an existing plan and ferreting out the important and vulnerable assumptions (both explicit and implicit) that underpin the plan. The methodology then proceeds to develop signposts to warn leaders of the impending breaking of an important assumption. Finally, the methodology involves the development of hedging actions that will permit the Army to deal with a changed environment or shaping actions to prevent such change.

Strategic Issues Affecting Quality of Life and New Overseas Bases

- **Develop innovative approaches to maintain quality of life for soldiers and their families**
 - Evaluate opportunities to leverage public/private or Army/community partnerships to increase investment in facilities/services
 - Analogous to Residential Communities Initiative for housing
- **Examine infrastructure implications of new bases envisioned by GDPR**
 - Evaluate needs to support operational capabilities and quality of life at Forward Operating Sites and Cooperative Security Locations

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The combined effects of modularity, GDPR, and BRAC will significantly increase the number of military personnel assigned to several installations, including Fort Bliss, Fort Carson, and Fort Riley. The construction of the operational facilities needed to accommodate additional units will be a financial and planning challenge, but the Army must also consider the support facilities that will be needed to maintain and enhance the quality of life of soldiers and their families, including housing, schools, child care, health care, churches, and recreational facilities. The Army must decide how much of these facilities and services will be provided on post and off post and whether there are opportunities to leverage public/private or Army/community partnerships to increase investment. For example, the Army has used the Residential Communities Initiative to leverage private-sector capital to renovate Army family housing, because the private sector can borrow against future expected rental payments to finance renovations, whereas the Army must budget up-front to pay for renovations. There may be other promising areas for such partnerships in providing other community or morale, welfare, and recreation facilities.

Another strategic issue is determining the infrastructure needs of Forward Operating Sites and Cooperative Security Locations. Forward Operating Sites will have a limited U.S. military support presence and are intended to support rotational forces and bilateral and regional training. Cooperative Security Locations will have little or no permanent U.S.

presence, but will provide contingency access and be a focal point for security cooperation activities. For the sites it operates, the Army will need to determine what infrastructure is needed to support intended uses (including operational capabilities and quality of life), what infrastructure currently exists, and what resources will be needed to provide infrastructure that is not available from the host nation.

Strategic Planning Issues to Enhance Installation Sustainability

- **Evaluate sustainability of current and planned training range usage**
- **Identify other federal lands with similar ecosystems/species to Army bases**
 - **Negotiate with other federal agencies to set aside wilderness in these areas to relieve pressures on Army land**
- **Conduct analysis of farmland near Army bases with critical missions and land-use pressures**
 - **Work with Department of Agriculture's Conservation Reserve Program to preserve farmland as buffer space near Army bases**
- **Assess how to provide more strategic guidance on installation sustainability plans**
 - **Include master planning and quality-of-life issues**

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We identified four strategic planning issues that would help the Army enhance the long-term sustainability of its installations.

Assessing and Enhancing the Long-Term Sustainability of Training Range Usage. Currently, many Army training ranges are being used very intensively, in some cases leading to degradation of training lands, such as severe erosion problems, and difficulties with managing habitats for threatened and endangered species. Increasing loss of suitable habitats on other federal lands and private lands means Army lands are becoming more important to protect these species. In addition to protecting natural resources, Army installations also need to protect cultural resources. In the future, training range demand is expected to increase. For example, today a Stryker Brigade Combat Team has a doctrinal battlefield footprint of 40 x 40 kilometers (1,600 square kilometers) and the future force is expected, by one estimate, to have a 75-kilometer radius (17,671 square kilometers) doctrinal footprint requirement (Knott and Natoli, 2004, p. 12). The Army Modular Force Plan and the Army Force Generation Model will increase the demand on ranges by adding BCTs to both the active and reserve components and by increasing the planned number of training events per BCT. However, increasing encroachment around Army bases threatens the Army's ability to acquire more training lands. Given potential shortages in training range space and the environmental requirements being placed on these range lands, the Army

needs to address the long-term sustainability of their availability, quality, and use. The Army should assess the long-term environmental sustainability of current and planned training range use and develop approaches to maintain and enhance ranges for sustainable use.

Using Other Federal Lands to Relieve Environmental Pressure on Army Land.

Because of increasing development and other activities on private lands and other U.S. government lands, U.S. military bases are becoming the last large, unfragmented tracts of habitat needed to protect critical species, biodiversity, and ecosystems. If Army bases become islands of habitat for threatened and endangered species, operational flexibility, especially training activities, can be limited. Current scientific evidence indicates that the Department of the Interior's Bureau of Land Management, the Department of Agriculture's Forest Service, and DoD lands are the federal lands that contain the most species and biodiversity that are at risk.²³ If biodiversity can be protected on Bureau of Land Management and Forest Service lands, military bases are less likely to become islands of critical habitat. The Army should identify other federal lands, especially Bureau of Land Management and Forest Service lands, with similar ecosystems and species to Army bases, and develop strategies to protect habitats on these lands, such as setting aside more wilderness and wilderness study areas, to relieve pressures on Army installations.²⁴

Farmland as a Buffer Against Encroachment Around Army Installations. Army bases are facing significant encroachment problems due to increasing development and suburban sprawl even in rural areas. At the same time, the Department of Agriculture is concerned about the loss of agricultural land and farms to sprawl and is investing funds to protect farmland. Many Army installations have farmland adjacent to them. The Army should identify privately owned farmland near its installations with critical missions and development pressures and explore options for the Department of Agriculture to use its funds to help preserve this farmland as buffer space against encroachment.

Developing Strategic Guidance for Installation Sustainability Plans. As discussed in the previous section, a number of Army installations have developed installation sustainability plans. An installation sustainability plan is developed through a strategic planning process conducted by local installations that focuses on creating sustainable, enduring installations by addressing mission, community and environmental issues. Since installation sustainability plans are a new, mostly local activity, there is inconsistency in the focus and scope of the plans from installation to installation. In March 2006, the Installation Management Command's Southeast Region released an informal guide on installation sustainability planning, which focuses mainly on how to develop the process and educates about sustainability. There is no clear guidance on which issues should be included in the

²³ Appendix B discusses this scientific evidence and explains the concept of biodiversity, which is a growing concern for Army installations.

²⁴ Other federal lands, including those owned by the Department of Energy and the Army Corps of Engineers, could also be included in such an assessment. However, given the evidence regarding the locations of species at risk and the advantages of gaining some quick results, Bureau of Land Management and Forest Service lands seem to be the best starting point for such an approach.

plans. There also is no HQDA or strategic guidance regarding common needs and potential synergies across installations. The Army should develop strategic guidance for installation sustainability planning to ensure that it comprehensively addresses installation sustainability issues, including synergies across multiple installations and long-term quality-of-life and master planning issues.

5. Data Collection and Metrics

Outline

- **Implications of DoD and Army strategic plans and initiatives**
- **Mapping to installation strategic plans**
- **Issues for infrastructure planning**
- **Data collection and metrics**

To measure how well the Army's current and projected infrastructure will meet emerging and future strategic needs, the Army may need to develop new data collection capabilities and metrics. As a first step in addressing this question, we identify the general types of metrics and supporting data needed to analyze the strategic planning issues described in the previous section, and then we examine existing databases to determine whether the necessary data are currently being collected. We also identify areas for which further investigation would be needed to determine whether the required data are currently accessible in a usable format. In Appendix C, we describe the data needs for each of the strategic issues in greater detail.

Several Types of Data Will Be Needed to Address Strategic Planning Issues

- **Operational data, such as expected frequency of deployments and training events**
 - Resulting requirements for infrastructure
- **Availability and quality of existing infrastructure**
- **Capital and operating costs**
- **Soldier and family use of and satisfaction with facilities and services**
- **Environmental and land-use data, such as location of threatened and endangered species on all federal lands**
- **Sustainability information**

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Looking across the set of strategic issues, several general types of data will be needed. First, operational data are needed on the types of units stationed at each installation, their equipment and personnel, and their expected levels of activity. These data include the expected “steady-state” frequency of deployments for a given unit (e.g., a maneuver brigade would deploy once every x years) and the additional number of deployments that would occur under “surge” conditions. They also include information on the expected type and frequency of training events, both at home station and at combat training centers. These data essentially determine the current and future demand for infrastructure.

These operational data must in turn be related to requirements for infrastructure. Based on DoD and Army guidelines, the Army computes the kinds and capacities (often expressed in square feet) of the facilities and other infrastructure believed to be needed to support operations and training events, deployment and mobility, personnel and their families, and equipment. For example, Army dental facilities are sized according to the total military population on the installation. These requirements, used in conjunction with operational data, help to determine the total kinds and amounts of infrastructure needed to support the Army.

A second type of data is the availability and quality of existing infrastructure. An inventory of existing infrastructure indicates how many facilities are available to meet current

needs and what additional capacity must be obtained to meet future needs. But, to conduct a proper gap analysis, it is not enough to know how much infrastructure presently exists. Because infrastructure can fall into disrepair if not properly maintained, it is important also to have information on the condition of existing infrastructure.

Third, data are needed on the capital costs of new infrastructure and the operating costs of both existing and new infrastructure. It should be noted that some of this cost data could vary based on regional—or national—factors. For example, the cost of information technology hardware such as routers or cabling would likely be the same at any U.S. installation, but the cost of construction labor or other inputs could vary depending on the local economy.²⁵ The costs of a wider range of inputs are likely to vary for new overseas bases (i.e., Forward Operating Sites and Cooperative Security Locations).

Fourth, in order to gauge the effectiveness of family and community facilities and services in retaining an all-volunteer force, data are needed concerning the use of these facilities and services, as well as users' satisfaction with them. Although use and satisfaction are related to the availability and quality of existing infrastructure, they have a somewhat different focus. They capture the usefulness and quality of the services provided in medical facilities, schools, gymnasiums, and other morale, welfare, and recreation facilities as perceived by the actual users. These data could help inform decisions on where Army investments are most needed and whether it might be preferable to rely to a greater extent on facilities and services located in the surrounding communities.

A fifth type of data involves land use and environmental conditions on federal land, including military bases, Bureau of Land Management land, and Forest Service land. Environmental data include information on the types and locations of different ecosystems, as well as the location of threatened and endangered species. For installations, it also is important to know where these environmental concerns impose current or possible future restrictions on training, testing, and other operations. These kinds of data are needed for the development of strategies to preserve habitats on other federal lands, such as setting aside wilderness and wilderness study areas, to relieve pressures on Army installations. To examine the potential for using farmland as a buffer against encroachment, information is needed on installation, community, and agricultural land use. This information includes the locations and sizes of training ranges, the presence of suburban and rural sprawl near installations, where and what encroachment concerns affect installations, and the location of nearby farmland.

Finally, information on the Army's and other organizations' sustainability approaches and practices would be needed to develop strategic guidance for installation sustainability plans. This information should include the approaches and practices used in each installation sustainability plan to address mission, environment, and community concerns, as well as industry and community sustainability approaches and practices that would also be

²⁵ Under the Davis-Bacon Act, the Army must pay locally prevailing union wages and fringe benefits for construction labor. These rates are set at the county level by the Department of Labor. See U.S. Department of Labor (undated).

applicable to Army installations. Relevant community and environmental data include information about quality of life; environmental issues, such as air, water, energy, land use, and species/habitat concerns; and built environment/infrastructure issues, such as buildings, roads, utilities, and master planning. In addition, information is needed on the operational issues involved with managing and running facilities similar to military installations, such as industrial and logistics sites, mixed residential housing, commercial facilities, and large tracts of land with natural resource concerns.²⁶

²⁶ For more information about the types of data needed to support research on developing guidance for installation sustainability plans, see Appendix C.

Potential Sources of Operational and Infrastructure Data

- **Operational data**
 - Tables of Organization and Equipment, ARFORGEN, other training schedules, Operational Requirements Documents for new systems
- **Infrastructure requirements**
 - Army Stationing and Installation Plan (ASIP) supplies units and population
 - Army Criteria Tracking System lists planning factors
 - Real Property Planning and Analysis Systems (RPLANS) brings together requirements and real property inventory
- **Infrastructure availability and quality**
 - Installation Status Report—Infrastructure evaluates quantity and quality of facilities
 - Based on data from ASIP, RPLANS, and the Integrated Facilities System, which provides real property inventory
 - Army Range Requirements Model Training Database
- **Capital and operating costs**
 - DoD Facilities Pricing Guide provides cost and pricing data for military construction, sustainment, modernization, and operations
- **Problems with database integration, accuracy, currency, and consistency**

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Operational and infrastructure data are currently located in a wide variety of sources. Operational data pertaining to units' missions, organizational structures, and personnel and equipment requirements can be obtained from their Tables of Organization and Equipment. ARFORGEN and other training requirements and schedules (such as the Army Training and Evaluation Program's Mission Training Plans and the Combined Arms Training Strategy) provide information on units' planned deployment and training cycles. Although strategic documents such as the *Army Modernization Plan* and the *Army Science and Technology Master Plan* do not include information on requirements for training land and ranges for new systems, more detailed information might be available in Operational Requirements Documents or from program management offices.

Information on infrastructure requirements can currently be found in several installation databases. The *Army Stationing and Installation Plan* (ASIP) contains the troop list and population for a given installation. Planning factors from a number of sources, including the federal government, DoD, and HQDA, can be found in the Army Criteria Tracking System. It includes criteria such as the requirement that there be 366 net square feet of living space per single junior enlisted soldier. It does not contain criteria pertaining to the requirements of Army major commands, however. The Real Property Planning and Analysis Systems (RPLANS), which references the Army Criteria Tracking System database,

brings together infrastructure requirements with an inventory of the Army's real property. Criteria from the major commands are recorded directly into RPLANS.

Data on infrastructure availability and quality can be found in the Installation Status Report (ISR) Infrastructure.²⁷ ISR Infrastructure documents and displays an installation's infrastructure status based on ratings comparing the quantity of facilities available to installation requirements and comparing the quality of installation facilities to established Army standards. It is built on data contained in ASIP, RPLANS, and the Integrated Facilities System, which provides real property inventory. Also, the Army Range Requirements Model Training Database provides information on training infrastructure. The Army Range Requirements Model uses training data to determine approximate live training throughput capacities and requirements for selected installations.

Information on capital and operating costs can be found in the *DoD Facilities Pricing Guide* (Office of the Deputy Under Secretary of Defense, 2007). The *Facilities Pricing Guide* contains cost and pricing data for military construction, replacement, sustainment, modernization, and operations. The guide includes unit cost data as well as related adjustment factors for selected DoD facility types, and is typically used in preparing military construction project documentation and other project-level estimates.

Given the variety of databases listed, there are potential problems for anyone attempting to cull operational and infrastructure data to support strategic planning or other endeavors. Although some databases directly reference data contained in others (e.g., ISR Infrastructure references ASIP and RPLANS), many databases are stand-alone, thereby requiring effort to integrate information from multiple sources. These databases are updated according to different reporting schedules, typically with a significant lag (e.g., annually), so the accuracy and currency of the data may be a problem. Furthermore, when data are entered separately into different systems, they may not be consistent from one database to another, requiring effort to reconcile them.²⁸

²⁷ ISR data are used to develop an annual three-part report: (1) Infrastructure, (2) Environment, and (3) Services.

²⁸ The Army is developing the General Fund Enterprise Business System to replace multiple legacy accounting and financial management systems and it will include a real property inventory system. However, it completed a limited technology demonstration in FY06 and is not scheduled to be fielded Army-wide until FY10. See General Fund Enterprise Business System (2007).

Potential Sources of Quality-of-Life Data

- **Army and DoD conduct periodic surveys of soldier and family attitudes**
 - DMDC's Status of Forces Surveys include questions on satisfaction with various services on a 2-year rotational pattern
 - Army Research Institute's (ARI) Sample Survey of Military Personnel includes attitudinal questions every other year
 - ARI's Survey of Army Families is conducted every 4–5 years in conjunction with the Army Community and Family Support Center
 - Army G-1 has contracted SAIC to perform a quality-of-life survey, but results are not yet available
 - Fitness centers, child care, and libraries frequently cited as most important
- **Installation Status Report (ISR) Services evaluates availability and quality of family and community services**
- **Difficult to prove a relationship between ISR metrics or surveys and retention decisions**
- **Frequency and length of deployments are affecting demand for services and cost of providing them**

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The term “quality of life” enjoys no precise and universally agreed-on definition, but it is commonly used broadly to include how soldiers feel about the jobs they perform, the adequacy and fairness of their compensation package, the extent and quality of their individual and collective training, the balance between work and time off, frequency and duration of deployments, the quality of their leadership and the attendant morale and *esprit de corps* within their unit, and the soldier support programs and facilities available to them.²⁹ Regardless of the precise definition one uses, though, the Army generally regards quality of life as important because the Army believes that quality of life can contribute to outcomes of importance: readiness of units and retention of soldiers. Another important factor in Army quality of life is the attitudes of soldiers’ families. The opinions of spouses and other family members affect soldiers’ views about the Army and their reenlistment decisions.

But even if a single definition of quality of life could be agreed to, one could not measure it with a high degree of precision because it is perceptual. Quality of life is whatever soldiers perceive it to be and perceptions are difficult to measure. At best, one can get a

²⁹ In a recent report (U.S. Government Accountability Office, 1999), GAO defined eight quality-of-life categories that were included in a survey. The eight were current monetary compensation, current military benefits, retirement benefits, military career issues, work circumstances, military culture, family support services, and other issues.

rough idea of how soldiers perceive their quality of life through attitudinal surveys about the factors that contribute to that quality. Further, one can measure programs and facilities at installations that may contribute to soldiers' perceptions of a good quality of life. But programs and physical assets are only necessary, not sufficient, to guarantee a good quality of life. How programs are administered, the quality and condition of physical facilities, and the training and attitudes of those who run programs and facilities also contribute to soldiers' perceptions. So, the combination of attitudinal survey results and the measurement of programs and facilities can provide only imperfect indicators of quality of life.

Both the Department of Defense, through its Defense Manpower Data Center (DMDC), and the Army, through its Army Research Institute for the Behavioral and Social Sciences (ARI) and Community and Family Support Center, conduct periodic attitudinal surveys of service members. Such surveys include questions related to quality of life.

DMDC conducts its Web-based Status of Forces Surveys of Active-Duty Members three times a year. The content of each survey is based on a long-term plan. For example, in July of each odd year, the survey elicits responses about the availability and satisfaction of service members with the various programs and services on installations, including schools, commissaries, exchanges, housing, and health care. In July of even years, the survey asks questions about satisfaction with the service and reenlistment intentions. These two surveys provide indications of the linkage between installation quality of life and retention. Surveys administered in November of odd years provide information about perceptions of outcomes: unit and individual readiness.

Within the Army, ARI administers the Army Personnel Survey Program, an Army-wide program for systematic, recurring collection of information on the attitudes, opinions, perceptions, behaviors, and characteristics of active-duty Army personnel and their dependent family members.

The flagship survey in the program, the semi-annual Sample Survey of Military Personnel, has been administered regularly on an Army-wide basis since 1943, first as the *Personnel Survey of the Army* and since 1958 as the Sample Survey of Military Personnel. Department of the Army agencies, field operating agencies, major commands, and other activity sponsors may submit items for inclusion in this survey. ARI first reviews requested items, then constructs and pre-tests questions. Generally, sets of questions intended to track trends in behaviors, attitudes, etc., are included in the Sample Survey of Military Personnel on a biennial basis (Department of the Army, 2006a).

The ARI program also includes the Survey of Army Families, conducted every four to five years in conjunction with the Army Community and Family Support Center, most recently in 2004–2005. The survey consists of questions related to housing, transportation, relocation, deployments and separations, the Army and the soldier, background, employment status, volunteer work, spouse's background, health care, recreation programs and installation services, children, and the Army way of life.

The Survey of Army Families has five objectives:

1. Obtain information directly from spouses.

2. Assess the impact of deployments and separations.
3. Assess family-member attitudes about the Army way of life as it affects families and about the quality of life for Army families.
4. Identify new concerns.
5. Supplement other evaluation and research efforts designed to improve Army support of families (Department of the Army, 2004b).

While some questions in both instruments vary from survey to survey, the efforts produce both cross-sectional and longitudinal information of value about how service members view various factors that affect their quality of life.

The Army G-1 has recently contracted with the SAIC (the Science Applications International Corporation) to undertake a substantial effort aimed at measuring quality of life, but no results are yet available.

A complementary source of information is the Army's Installation Status Report, which provides information about physical assets (infrastructure), environmental factors, and quality-of-life services and programs on installations. ISR Services reports on five classes of programs: Army Community Service; Child and Youth Activities; Sports, Recreation, and Libraries; Army Lodging; and Business Programs. Table 5.1 shows the specific metrics that the ISR captures in these five classes of programs. The nature of the metrics ranges from simple yes/no certifications to survey scores and percentages of the population that use the facilities.

Collectively, the ISR and existing survey efforts provide useful insights into quality-of-life facilities and programs as well as how soldiers perceive them and their resulting quality of life. Both DMDC and ARI respond to appropriate requests for ad hoc surveys that can supplement periodic surveys.

But the existence of physical assets and programs alone does not translate directly into the quality of life that soldiers perceive; that is why attitudinal surveys are an important complement to the information in the ISR. Perceived quality of life may or may not correlate with the extent of physical assets, services, and programs on installations.

A second weak link in the process is inferring a relationship between either individual retention behavior or unit readiness and perceptions of quality of life. The link is intuitively pleasing but not well established in the literature. Nevertheless, it is prudent to continue to monitor and collect such information so the Army leadership can take action as they deem appropriate.

The pace of deployments also affects both the demand for and the supply of family and community support services (U.S. Army Morale, Welfare, and Recreation, 2006). When soldiers deploy, family members are likely to increase their demand for support services, such as child care and respite care, and post-deployment family reintegration counseling. Spouses are also a source of employees and volunteers who help operate community support activities. When soldiers deploy, spouses may have to cut back on some of these activities, creating challenges for the provision of morale, welfare, and recreation services.

Table 5.1
Installation Status Report Metrics

Army Community Service Mission Box Score
DoD Certification of Child Development Services Program
DoD Certification of School Age Services Program
Army Certification of Youth Program
Accreditation of Child Development Center Program
Accreditation of School Age Services Program
School Liaison Officer under the Child and Youth Services Structure
Youth Services Participation Goal
Child Care Space Allocation
Sports and Fitness Leisure Needs Survey Score
Recreation Leisure Needs Survey Score
Library Leisure Needs Survey Score
Sports and Fitness Mission Box Score
Recreation Mission Box Score
Library Mission Box Score
Sports and Fitness % of Population
Library % of Population
Automotive % of Population
Arts & Crafts % of Population
Outdoor Recreation % of Population
Recreation Center/Community Activities Center % of Population
Entertainment % of Population
Garrison Net Income Before Depreciation (NIBD) vs. Budgeted NIBD
Average Score: Customer Comment Cards
Occupancy Rate

Potential Sources of Environmental and Land Use Data

- **For Army installations**
 - Installation Natural Resource Management Plans
 - Training Circular 25-1, Land Use Requirements Studies
 - Geographic Information System Repository
 - Army Environmental Center's Encroachment Condition Module
 - Army Compatible Use Buffer program
- **For surrounding communities and other federal lands**
 - Dept of the Interior: Bureau of Land Management and U.S. Geological Survey
 - Dept of Agriculture: Forest Service, Farm Service Agency, and Natural Resources Conservation Service
 - NatureServe, State Natural Heritage Programs, and The Nature Conservancy
- **Ecosystem and ecoregional assessments and collaborations can provide integrated information**

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For strategic issues related to the environmental and land use, it is important to have data from the installation; the surrounding area, including communities, farmland, and other uses; and other relevant federally owned land. There are several potential data sources for each. Ideally, these data should be entered into a Geographic Information System (GIS) database to enable spatial analysis and assessments.

Installation Natural Resource Management Plans are good general sources of data on threatened and endangered species, habitat, and ecosystem locations at individual installations. Each installation is required by law to develop an Installation Natural Resource Management Plan with the assistance of the U.S. Fish and Wildlife Service and state fish and wildlife agencies and update it annually (U.S. Department of Defense and U.S. Fish and Wildlife Service, 2004). Installation Natural Resource Management Plans often include information about threatened and endangered species located on the installation, the habitats supporting these species, and any related restrictions on training, testing, or other operational uses.

For example, Fort Benning's Installation Natural Resource Management Plan lists 96 species of conservation concern located on the installation,³⁰ including four amphibian, eight bird, seven fish, four mussel, nine reptile, and 60 plant species (Fort Benning, 2001, p. 66). The plan includes detailed information about where the federally listed threatened and endangered species are located on the installation. For example, in 1999, Fort Benning had 186 active manageable clusters and 28 known, active unmanaged clusters of the red-cockaded woodpecker. Fort Benning had entered this information in a GIS database, along with information on training restrictions due to red-cockaded woodpecker nesting, but had not yet done so for the specific locations of most non-federally listed species of concern. Similarly, Fort Carson's Installation Natural Resource Management Plan documents the locations of mountain plover and black-tailed prairie dogs, species of concern that have been proposed as federally listed threatened and endangered species, and had entered this information into a GIS database.³¹ More detailed information on land usage restrictions may also be available from installation range and environmental management offices, and sometimes is entered into the installation GIS system.

Army Training Circular 25-1 (Department of the Army, 2004a) specifies the land area required for each training task, the number of annual repetitions, and the number of days the land is needed. Given the units assigned to an installation and the set of training tasks they must complete, the size of the largest training event and the total land needed to accommodate the sum of all training events in square kilometers per day can be calculated using the Army Training Land Analysis Model. Installations conduct Land-Use Requirements Studies to assess the adequacy of existing training land to meet training range requirements and identify potential shortfalls. For example, Fort Bragg's sustainability plan (Fort Bragg, 2006) states, "Fort Bragg maintains 161,597 acres of land for training. Of this, only 72,236 acres have no restrictions for use. The Land-Use Requirements Study conducted in 1995 concluded that Fort Bragg has a total training area shortfall of approximately 125,000 acres (combining both the shortfalls for maneuver area and impact area)." Land-Use Requirements Studies should be reviewed and updated when significant changes to mission, doctrine, or force structure occur, but some may not yet have been modified to account for planned changes due to modularity, GDPR, and BRAC. Training Circular 25-1 was last updated in 2004 and provides a "first look" at the implications of Army transformation for training land requirements, but does not try to forecast the impacts of other expected changes.³²

Acquiring environmental and land-use data from each Installation Natural Resources Management Plan and Land-Use Requirements Study would be time consuming, however.

³⁰ A species is considered "of concern" at Fort Benning if it is a federally listed threatened or endangered species, is listed by the states of Alabama or Georgia as threatened or endangered, or is otherwise identified as a candidate species, species of special concern, state protected species, rare species, unusual species, or a watch-list species.

³¹ For more information see Gene Stout and Associates (2002, 2003).

³² Also see Department of the Army (1997) and Rubenson et al. (1999).

Ideally, there should be a centralized source for such data, but for the most part, the Army does not yet have one. There is a centralized source for some of the basic installation GIS data that can be used as a starting point. The Assistant Chief of Staff for Installation Management has developed an Army-wide repository for installation-related geospatial data called the Geographic Information System Repository.³³ The Geographic Information System Repository contains basic installation boundary, imagery, roads, ranges, and other key data. It does not yet include species and habitat information, but could be extended to include such information.

A centralized source for data on training, testing, and other operational restrictions is being developed by the Army Environmental Center as part of their Encroachment Condition Module. The Encroachment Condition Module is a GIS-based system to measure the impacts of encroachment on Army training. It will track the impact on training of various encroachment factors, including threatened and endangered species, critical habitat, and wetlands, by time and specific location. It will track 10 types of restrictions: no digging, no training, no bivouacking, no live fire, no heavy maneuver, no light maneuver, no smoke, no pyrotechnics, no dismount, and no flyover.

The Army Compatible Use Buffer program can provide more detailed data on encroachment and land use around installations. The Army Compatible Use Buffer program works to establish buffer areas around Army installations to limit the effects of encroachment and preserve the Army's ability to use installation land to support training and other missions.

Some data on the current supply of training ranges can be obtained from the Army's Sustainable Range Program. For example, a sustainable range inventory is conducted yearly to identify current range capabilities, including the size and space of ranges. These data are centralized and housed in a GIS. However, data on range quality or restrictions on use is more problematic. The Sustainable Range Program may have some data on these issues, but it may not be up to date since such conditions change frequently. These data would need to be updated more than once a year to remain current.

Data on other federal lands also tend to be fragmented. Sources for data about species and habitats on federal land include the agencies that own the land, such as the Bureau of Land Management and Forest Service. They also include the U.S. Geological Survey, which has extensive biological and GIS data for the United States. In addition, nongovernmental organizations, such as NatureServe and The Nature Conservancy, are good sources of information about rare and endangered species and threatened ecosystems. NatureServe represents the U.S. network of state biological inventories—known as natural heritage programs—operating in all 50 states.³⁴ This state natural heritage information includes information about federal lands. The Nature Conservancy has partnered with many different federal agencies, including military bases, to inventory locations of species and ecosystems of concern.

³³ For more information see Army Installation Geospatial Information and Services (undated).

³⁴ For more information, see NatureServe (undated).

Most installations participating in the Army Compatible Use Buffers program have extensive GIS data on land use around their bases. However, some bases do not participate in the program. Additional land-use data could be acquired from local and state government organizations (such as state geospatial data clearinghouses), the Department of Agriculture, and the American Farmland Trust and other nongovernmental organizations, including state land trusts. For example, a state land trust, Colorado Open Lands, has extensive information about the farmland and ranches near Fort Carson and the Pinon Canyon Maneuver Site, as does The Nature Conservancy, because of suburban and rural sprawl problems in Colorado and the desire to protect open spaces, farms, and ranches in the state. These organizations can also provide information about the trends and pressures on such farmlands.

For some of these strategic issues, information is also needed about conservation programs and policies that can be used to protect habitat and preserve undeveloped land as a buffer around installations. The regional and local managers of federal lands of interest (at the Forest Service and Bureau of Land Management, for example) can be a good source of information on both management and policies. Studying these agencies' current and past national and regional policies, including policies about road building, wilderness, and multiple land uses, can help determine management approaches and options. Department of Agriculture organizations, such as the Farm Service Agency and the Natural Resources Conservation Service, are obvious sources for information on farmland conservation programs. In addition, it is important to understand state and local government policies that can be used to help preserve farmland, so these entities can be useful sources of information. The American Farmland Trust can also provide information on farm conservation activities and policies.

In a few regions of the country, collaborative organizations can provide integrated information about military installations and other regional lands. For example, the Office of the Deputy Under Secretary of Defense for Installations and Environment has been working with the states of Florida, Georgia, South Carolina, and North Carolina to form the Southeast Regional Partnership for Planning and Sustainability. This partnership is a pilot effort to develop a working regional partnership between DoD, the Southeastern states, and other stakeholders for pursuing sustainability. For the Southeast Regional Partnership for Planning and Sustainability, the Conservation Fund combined DoD installation data with ecological and land-use datasets to produce maps that can be used to assess encroachment and potential buffer areas around installations and to develop conservation corridors of mutual benefit. These data are also a good starting point for some of the ecosystem concerns of Army installations in this region.

Ecosystem and ecoregional assessments and collaborations can also be a good source of integrated data. For example, there is a Central Shortgrass Prairie partnership among federal, state, nongovernmental organization, and university scientists and private landowners to assess and manage the central shortgrass prairie ecoregion. As part of the Central Shortgrass Prairie partnership, The Nature Conservancy has taken the lead in assessing species and habitat locations and has developed a GIS database of the locations of key central shortgrass prairie species, such as the mountain plover and black-tailed prairie

dog.³⁵ Similarly, the Gulf Coastal Plain Ecosystem Partnership, a group of large landowners who are working together to conserve and restore the dwindling longleaf pine ecosystem and the unique aquatic resources of northwest Florida and south Alabama, is a source of information about other federal and state lands that contain the longleaf pine ecosystem. Such sources can provide information about the quantity and quality of some of the species and habitats of concern on installations. They are also good sources of information on how federal land in their region is being managed.

³⁵ For more information, see Neely et al. (1998).

Areas for Further Investigation

- **In general, operational, land-use, and environmental data are difficult to obtain and come from a variety of sources**
 - **We have not yet located data on requirements for reachback capabilities, training areas needed by new weapon systems, or facilities needed at new overseas bases, for example**
 - **Army has focused on land-use and environmental data on installations, needs to acquire additional data from diverse external sources to address installation sustainability issues**
- **Army needs to integrate, standardize, and update its infrastructure data more frequently**
 - **Clear data definitions and business rules for data collection**
- **Not clear how often planning factors and other requirements are reevaluated and updated**

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As the previous few slides indicated, there are a multitude of data sources in various Army and external organizations that would need to be consulted to assess the strategic planning issues we described. In some cases, information is gathered into centralized databases, but in others, it would need to be collected from each installation or from multiple documents or organizations. We have not yet located sources for some types of operational data, such as requirements for reachback capabilities, the size of training areas that will be needed by new weapon systems, or the types of facilities that will be needed at Forward Operating Sites and Cooperative Security Locations. Environmental and land-use data are more readily available for Army installations than for other federal and community lands. These data would need to be collected from a variety of external sources in order to examine the potential for preserving habitat on other federal lands or for preserving farmland as a buffer against encroachment.

Even when centralized data sources exist, related data may be spread across multiple systems or entered separately into more than one system, creating the potential for discrepancies and the need for data users to reconcile conflicting sources. Databases may be updated on different schedules, so it is difficult to establish a common baseline. A more integrated data collection system based on standardized data definitions and updated more frequently (or even continuously) would help the Army better manage its infrastructure.

Finally, it is not clear how frequently the planning factors that are used to establish requirements for facilities and training land are updated. These factors may need to be reviewed on a regular basis to ensure that they reflect ongoing changes, such as modularity and the ARFORGEN training cycle.

6. Conclusions

Conclusions

- **Army installations must adapt to changing strategic environment**
 - Short-term focus on building infrastructure to support modularity, GDPR, ARFORGEN, and BRAC
 - Over longer term, need to consider strategic issues such as:
 - Supporting more frequent deployments
 - Meeting changing needs for training land and facilities
 - Addressing environmental challenges
 - Hedging against risk and uncertainty
- **DASA(SI) can help coordinate strategic planning efforts across Army organizations**
 - Act as a proponent for improved infrastructure data needed to support long-term analysis

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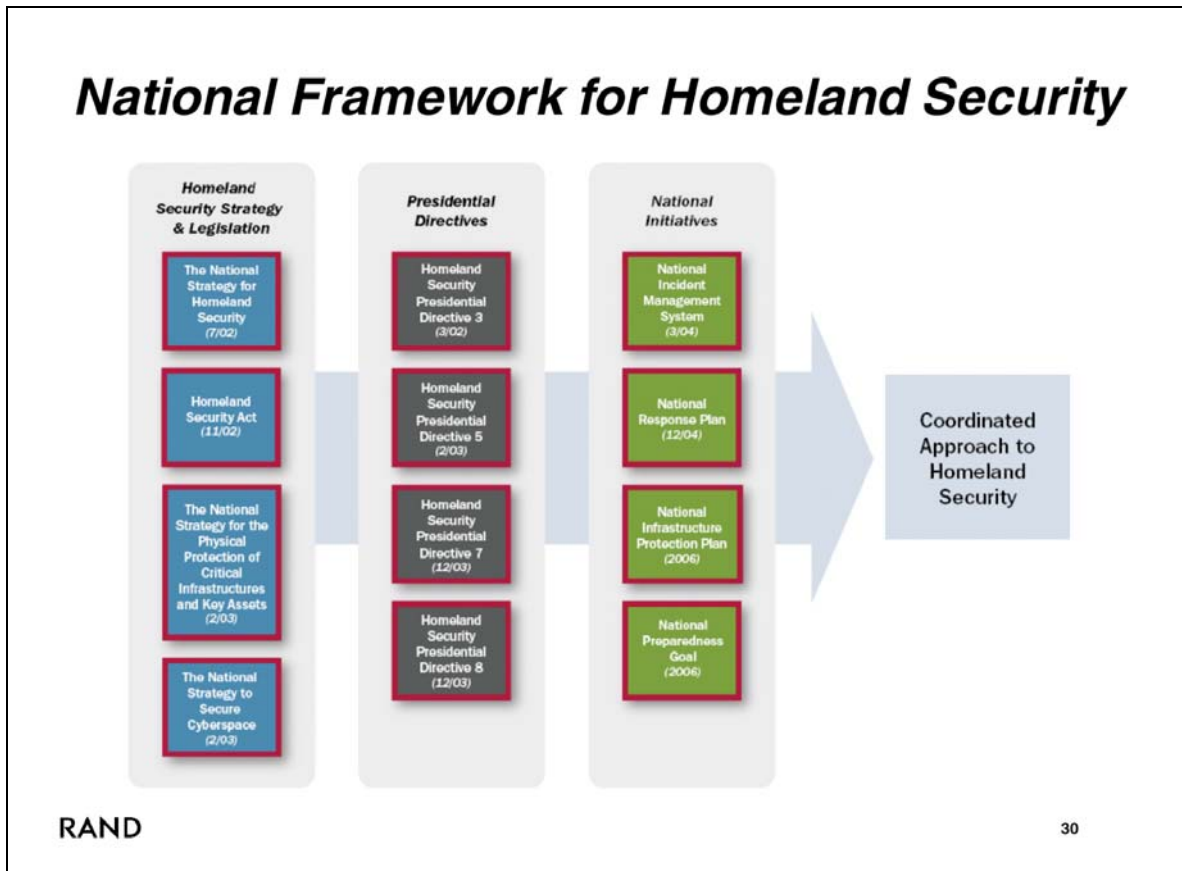
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The Army's installations face both short-term and long-term challenges in adapting to changes in the strategic environment and responding to DoD and Army initiatives. Over the next five to six years, installations will need to accommodate changes in stationing and training schedules occurring as a result of modularity, GDPR, ARFORGEN, and BRAC. Over the longer term, these initiatives raise additional issues that should be considered. Installations will need to support more frequent deployments, both in the peacetime "steady state" and for sustained contingency operations. Increases in the number of U.S.-based units and joint training exercises, as well as the introduction of ARFORGEN training schedules and new weapon systems, imply changing needs for training land and facilities. Installations also face encroachment and environmental challenges due to potential increased use of training land, urban and suburban sprawl, and the need to preserve cultural and natural resources on Army land. Finally, the Army must consider what long-term risks and uncertainties could affect the future demand or supply of Army infrastructure and how best to hedge against these risks.

As a proponent for a longer-term, strategic approach, the Deputy Assistant Secretary of the Army for Strategic Infrastructure (DASA(SI)) can help the Army address these challenges by coordinating strategic planning efforts across Army lines of responsibility (e.g., training, procurement). It can also be a proponent for more integrated, accurate, and timely infrastructure databases that are needed to support research into long-term infrastructure issues.

Appendix

A. Homeland Security



A new and increasingly well-developed structure has been created to allow homeland security efforts to function effectively within the federal framework of government specified in the U.S. Constitution. It balances the separate authorities, responsibilities, powers, and capabilities that local, state, and federal government entities (including the federal agencies and military services) have under the Constitution to address the nation's needs for a coordinated approach in this area.

As shown in this chart,³⁶ this structure is founded on legislation, implements a national strategy, is guided by presidential directives, and is actuated in national-level plans that are supported by the types of emergency response and disaster plans familiar at the service and installation levels. This appendix provides a more detailed description of each of these parts of the homeland security framework.

³⁶ The source of this chart is U.S. Department of Homeland Security (2006a), p. 72.

Legislation and National Strategies

The Homeland Security Act (PL 107-296) provides the primary basis for the homeland security mission and establishes a requirement for national-level plans to coordinate homeland security efforts such as incident response and infrastructure protection. It assigns primary missions to the Department of Homeland Security³⁷ and augments earlier legislation dealing with homeland security, such as the Robert T. Stafford Disaster Relief and Emergency Assistance Act (PL 93-288).

The *National Strategy for Homeland Security* (Office of Homeland Security, 2002), the *National Strategy for the Physical Protection of Critical Infrastructures and Key Assets* (Executive Office of the President, 2003b), and the *National Strategy to Secure Cyberspace* (Executive Office of the President (2003c) together provide the vision and strategic direction for the homeland security mission on a national basis, including not only the federal agencies and military services, but also state and local government authorities and those private-sector entities with roles or equities in the mission.

The President released the *National Strategy for Homeland Security* in 2002.³⁸ It calls for the development of “interconnected and complementary homeland security systems that are reinforcing rather than duplicative, and that ensure essential requirements are met . . . [and] provide a framework to align the resources of the Federal budget directly to the task of securing the homeland” (Office of Homeland Security, 2002, p. 4); it establishes protection of America’s Critical Infrastructure and Key Resources, which includes the Defense Industrial Base, as a core homeland security mission; and it articulates the vision for a unified “American Infrastructure Protection effort” (p. 29).

The *National Strategy for Homeland Security* notes that DoD contributes to homeland security through the military missions it undertakes overseas, defense of the homeland, and support to civil authorities. It specifically lists three circumstances under which DoD would be involved domestically in improving homeland security:

- “In extraordinary circumstances, the Department would conduct military missions such as combat air patrols or maritime defense operations.”
- “Second the Department of Defense would be involved during emergencies such as responding to an attack or to forest fires, floods, tornadoes, or other catastrophes.”
- “Finally, the Department of Defense would also take part in ‘limited scope’ missions where other agencies have the lead—for example, security at a special event like the recent Olympics.” (p. 13)

³⁷ These include preventing terrorist attacks within the United States; reducing the vulnerability of the United States to terrorism at home; minimizing the damage and assisting in the recovery from terrorist attacks that occur; and acting as the focal point regarding natural and man-made crises and emergency planning.

³⁸ The President established the Office of Homeland Security in October 2001 as part of the Executive Office of the President. It preceded the Department of Homeland Security, which was formed in 2003.

The *National Strategy for Homeland Security* also emphasizes DoD's role in emergency preparedness and response, noting, for example, that DoD has specialized skills and transportation capabilities that would be useful in supporting civil authorities in the event of a bioterrorist attack. This support could also take the form of "providing technical support and assistance to law enforcement; assisting in the restoration of law and order; loaning specialized equipment; and assisting in consequence management" (p. 44).

A number of additional strategic documents deal with homeland security and are related to DoD's mission and defining its role in homeland security. These include

- *The National Strategy to Combat Weapons of Mass Destruction* (Executive Office of the President, 2002c)
- *The National Strategy for Combating Terrorism* (Executive Office of the President, 2003a)
- *The National Strategy for Maritime Security* (U.S. Department of Defense and U.S. Department of Homeland Security, 2005)
- *The National Intelligence Strategy of the United States of America* (Office of the Director of National Intelligence, 2005).

Presidential Directives

Homeland Security Presidential Directives (HSPDs) set national policies and executive mandates for specific programs and activities. As a matter of presidential executive authority, these directives apply to all federal agencies and establish responsibilities for both leadership and coordination.

The first, HSPD-1, *Organization and Operation of the Homeland Security Council* (Executive Office of the President, 2001a), was issued on October 29, 2001, shortly after the attacks on September 11, 2001. It establishes the Homeland Security Council, which is responsible for arbitrating and coordinating any policy issues that may arise among the different departments and agencies. It was followed by a series of presidential directives regarding the actions required to prevent terrorist attacks within the United States; to reduce its vulnerability to terrorism, major disasters, and other emergencies; to minimize the damage from such incidents; and to recover from those incidents that do occur. The directives that may have an effect on Army infrastructure include

- HSPD-2, *Combating Terrorism Through Immigration Policies* (Executive Office of the President, 2001b)
- HSPD-3, *Homeland Security Advisory System* (Executive Office of the President, 2002a)
- HSPD-4, *National Strategy to Combat Weapons of Mass Destruction* (Executive Office of the President, 2002b)

- HSPD-5, *Management of Domestic Incidents* (Executive Office of the President, 2003d)
- HSPD-7, *Critical Infrastructure Identification, Prioritization, and Protection* (Executive Office of the President, 2003e)
- HSPD-8, *National Preparedness* (Executive Office of the President, 2003f).

Of these, HSPD-5, HSPD-7, and HSPD-8 are likely to have the most direct effects on Army infrastructure on a day-to-day basis.

HSPD-5 addresses the national approach to domestic incident management. It requires the Department of Homeland Security to lead a coordinated national effort involving the other federal departments and agencies; state, local, and tribal governments; and the private sector to develop and implement a *National Incident Management System* and the *National Response Plan*.

HSPD-7 establishes the U.S. policy for enhancing protection of the nation's critical infrastructure and key resources. It mandates the Secretary of Homeland Security to lead development and implementation of a *National Infrastructure Protection Plan* as the primary vehicle for implementing infrastructure protection and designates him to serve as the nation's focal point for the security of cyberspace. The *National Infrastructure Protection Plan* is supported by a series of Sector Specific Plans, which are developed and maintained by agencies designated by the President in HSPD-7. These detail the approach to infrastructure protection for each sector, including the Defense Industrial Base sector, which is the responsibility of DoD.

HSPD-8 mandates development of a National Preparedness Goal designed to help entities at all levels of government build and maintain the capabilities to prevent, protect against, respond to, and recover from major events "to minimize the impact on lives, property, and the economy."

National Plans

As directed by homeland security legislation and presidential directives, the federal government has developed a set of national-level plans that implement the guidance provided by the Congress and the President. These plans are typically national in scope, with applicability to all homeland security partners, including those in the private sector, at the local level, at the state level, and in the federal government.

The National Incident Management System (U.S. Department of Homeland Security, 2004a) is the standardized national system for incident management. It provides a uniform doctrine and organizational structure for command and incident management. HSPD-5 requires all federal departments and agencies (including DoD) to adopt the *National Incident Management System* and to use it in their individual domestic incident management and emergency prevention, preparedness, response, recovery and mitigation programs and activities.

The National Response Plan (U.S. Department of Homeland Security 2004b) presents a comprehensive framework for the management of domestic incidents that require coordination and effective response by an appropriate combination of federal, state, local, and tribal governments; the private sector; and nongovernmental organizations. The *National Response Plan* codifies federal agency responsibilities, operational processes, and protocols for domestic incident management (i.e., prevention, preparedness, response, and recovery) and addresses the full spectrum of potential hazards, including terrorist attacks, natural disasters, and catastrophic man-made accidents.

The National Infrastructure Protection Plan (U.S. Department of Homeland Security, 2006a) and its associated Sector Specific Plans establish the steady-state level of protection for critical infrastructure and key resources by helping to focus resources, including those in the federal budgets of the individual agencies, where investment yields the greatest return in terms of national risk management. Under the *National Infrastructure Protection Plan*, Sector Specific Agencies (including DoD) have annual reporting requirements on their progress and federal budget commitments for infrastructure protection within their sector.

The Interim National Preparedness Goal (U.S. Department of Homeland Security, 2005) provides readiness targets, priorities, standards for assessments and strategies, and a system for assessing the nation's overall level of preparedness across four mission areas: prevention, protection, response, and recovery. Although referred to as a "goal," this document is in effect a plan for the coordinated implementation and ongoing activities needed for the individual homeland security national plans.

The Secretary of Defense has made formal commitments related to these national homeland security plans. Along with the other department secretaries and agency administrators who are signatories to the formal Letters of Agreement related to the *National Response Plan* and the *National Infrastructure Protection Plan*, the Secretary of Defense has committed to a number of actions that may have a direct impact on Army infrastructure. These include

- working with the Secretary of Homeland Security, as appropriate and consistent with DoD's own agency-specific authorities, resources, and programs, to coordinate funding and implementation of programs that enhance homeland security
- supporting national plan concepts, processes, and structures, including designating representatives to staff interagency coordinating structures, as required
- modifying existing interagency and agency incident management and emergency response plans to facilitate compliance with the national plans
- developing, exercising, and refining headquarters, regional capabilities and partnerships with appropriate state, regional, local, tribal, and international entities; the private sector; and nongovernmental organizations as required to ensure sustained operational readiness in support of homeland security efforts (U.S.

Department of Homeland Security, 2004b, p. iii, and U.S. Department of Homeland Security, 2006a, p. iii).

DoD Roles in Homeland Security

DoD and Army guidance related to homeland security roles includes the *Strategy for Homeland Defense and Civil Support* (U.S. Department of Defense, 2005), Joint Publication 3-26 on Homeland Security (Chairman of the Joint Chiefs of Staff, 2005), and the *Department of the Army Analysis and Recommendations, BRAC 2005* (Department of the Army, 2005e), which discusses infrastructure requirements related to homeland security.

Some of the infrastructure implications of the *Strategy for Homeland Defense and Civil Support* echo those resulting from the *National Defense Strategy* and *National Military Strategy*. For example, homeland defense requires the forward presence of U.S. military forces that are trained, ready, and postured to intercept potential enemies, eliminate enemy sanctuaries, and maintain regional stability. It also requires an information infrastructure that provides an integrated, interoperable worldwide network linking sensors, decisionmakers, and warfighters.

However, other implications are touched on, but do not receive as much emphasis in the *National Defense Strategy* and *National Military Strategy*. These include force protection, mission assurance, and training requirements for forces that are expected to take on Defense Support to Civil Authorities missions in addition to other warfighting missions.³⁹ Force protection is defined as actions taken to prevent or mitigate hostile actions against DoD personnel (including family members), resources, facilities, and critical information. Installation commanders and facility managers have an inherent responsibility to protect the forces and installations under their command. The *Strategy for Homeland Defense and Civil Support* places particular emphasis on protection from chemical, biological, radiological, nuclear, and high-yield explosive attacks and indicates that DoD is providing improved defense against these threats at 200 critical installations in the U.S. and abroad and is updating doctrine and guidance for all installations.

Mission assurance is defined as the certainty that DoD components can perform assigned tasks or duties in accordance with the intended purpose or plan. In part this requires DoD to identify infrastructure critical to the accomplishment of its missions, assess the potential effect of a loss or degradation of critical infrastructure on DoD operations, and manage the risk of loss or degradation through protection, remediation, or mitigation efforts. Within this framework, the Army will need to undertake a broad set of actions, to include ensuring that the DoD Sector Specific Plan for the Defense Industrial Base includes infrastructure that is vital to the conduct of its key missions and the operation of its key

³⁹ U.S. Department of Defense (2005) states that, other than a dedicated command and control element (the Joint Task Force–Civil Support) and Army National Guard WMD Civil Support Teams, DoD will rely on dual-capable forces for the domestic incident management mission. It also states that DoD will focus attention on the most effective use of the competencies of National Guard and Reserve organizations for civil support missions.

installations. In addition, installation managers must ensure that the contractors they employ have adequate protective measures in place by modifying contract language to specify required service availability, priority of restoration, and asset protection. Further, the Army must maintain continuity of operations to support senior leadership decisionmaking and command and control during a national emergency by improving policies for personnel dispersion, leveraging information technology to improve crisis coordination, and improving relocation facilities.

For the most part, DoD plans to address Defense Support to Civil Authorities missions with dual-capable forces that also have warfighting missions. DoD must identify, train, and equip these forces for their civil support missions (including response to chemical, biological, radiological, nuclear, or high-yield explosive incidents) in addition to their warfighting missions. Given that these forces are expected to operate in support of federal, state, local or tribal authorities, they must also participate in coordinated training and exercise programs with other security partners. These additional training requirements for dual-capable forces may imply the need for different types of training facilities or different usage patterns for existing facilities and may imply greater reliance on simulation-based or distance learning to help offset this additional training requirement.

The BRAC process was intended to include homeland security–related impacts for Army infrastructure, because the BRAC selection criteria used to determine the military value of installations involved homeland security. Specifically, Department of the Army (2005e) criterion 2 (of 8) states that the Army and other services should consider:

The availability and condition of land, facilities and associated airspace (including training areas suitable for maneuver by ground, naval, or air forces throughout a diversity of climate and terrain areas and staging areas for the use of the Armed Forces in homeland defense missions) at both existing and potential receiving locations. (p. 4)

In other words, a homeland security dimension was added to base realignment and closure decisions by requiring the retention training and of staging areas for homeland defense. How the Army addressed this requirement, therefore, could provide insight into the implications of homeland security for Army infrastructure.

However, the Army BRAC report essentially concluded that the impact of homeland security missions on Army stationing and infrastructure was unclear. Its review of Army and joint documents as well as interviews with senior Army leaders suggested that, at the time BRAC decisions were made, the homeland security mission had not yet been clearly defined, and that the corresponding requirements had not yet been established.⁴⁰ Excerpts from the (anonymous) senior-leader interviews illustrate the issue:

⁴⁰ Note that Joint Publication 3-26 (dated August 2005) and the DoD Strategy for Homeland Defense and Civil Support (dated June 2005) had not yet been released at the time the BRAC recommendations were announced (May 2005).

- “Homeland Security is more of a [Reserve Component/National Guard] role with the [Active Component] as a back-up. The training requirements for it are a little different. We don’t need large land areas but we do need regional [Military Operations in Urban Terrain] sites.” (Department of the Army, 2005e, p. B-79)
- “If there has been any impact on installations from the Homeland Security mission, I’m not aware of it, other than the establishment of [Chemical, Biological, Radiological, and Nuclear] Teams and a heightened desire for force protection. If the Guard and Reserves are going to have a role in it that needs to be taken into stationing considerations.” (Department of the Army, 2005e, pp. B-79–B-80)

The Army BRAC report summarizes that domestic homeland defense would not typically involve active-duty forces but could become a viable mission for the reserve component; that the active force primarily performs its homeland defense role outside U.S. shores; and that active forces likely should not be re-stationed to perform this mission.

B. Biodiversity

One of the most significant environmental drivers currently and over the next few decades is biodiversity; specifically, the rate that it is being lost. Biodiversity loss is a key driver with respect to threatened and endangered species and pressure on Army lands to protect such species and habitat. Scientific evidence shows the importance of biodiversity trends to future environmental health and the Army. We summarize this evidence here. First, to set the context, a brief discussion is presented that defines biodiversity, why it is important, why it is a worldwide concern, and why it is likely to be of increasing significance in the future. Next, we discuss the main threats to biodiversity, which come from nonmilitary activities. Finally, we discuss the key locations where much of the remaining biodiversity at risk is found: on federal lands owned by the Bureau of Land Management, Forest Service and DoD, making them the most important spots to protect U.S. biodiversity. Thus, the Army and other services should act strategically to ensure that other federal agencies are protecting biodiversity in order to reduce environmental pressures on military installations.

Definition of Biodiversity

In its simplest form, biodiversity can be defined as biological variety. It refers to the number and diversity of species, the genetic material of those species, and the natural communities, ecosystems, and landscapes in which those species live. In evaluating and conserving biodiversity, four main levels or types of diversity are considered: genetic, species, ecological, and landscape diversity. The variety of these types and variability within and among them are important concepts of biodiversity (Stein, Kutner, and Adams, 2000, pp. 7–8). Understanding the dynamics of these complex elements over time for the Earth's diverse ecosystems and habitats is not easy and is a field of much scientific research. Despite the complexity of biodiversity concepts and dynamics, at the most basic level, as species are lost, so is biodiversity.

Importance of Biodiversity

Biodiversity is important to maintain healthy and diverse natural resources and systems that humans depend on. Arguments for preserving biodiversity include economic, environmental, genetic, aesthetic, and moral. The main economic and environmental benefits of biodiversity include contributions to organic waste disposal, soil formation, biological nitrogen fixation, bioremediation of chemical pollution, crop and livestock genetics, biological pest control, biotechnology, plant pollination, ecotourism, and the harvest of food, animals, and pharmaceuticals from the wild (Pimentel et al., 1997). For

example, economic benefits can arise from genetic resources, which play an important role in increasing crop and livestock yields. An example of an environmental benefit is the role of biodiversity in treating toxic chemical sites. Biological treatments, which use microbes and plants to degrade chemical materials, can decontaminate polluted sites (bioremediation) and purify hazardous wastes in water (biotreatment). A conservative estimate of the annual economic and environmental benefits of biodiversity in the United States is \$319 billion; worldwide, it is \$2.928 trillion.⁴¹ Other estimates of the worldwide economic benefits of biodiversity range as high as \$33 trillion per year (Costanza et al., 1997).⁴²

Biodiversity has been recognized as important by the environmental and scientific communities because of its numerous benefits and the rapid rate at which it is being lost. Increased human activities and rapidly growing global population threaten the earth's biodiversity. Worldwide, tens of thousands of species are becoming extinct every year (Smith and Smith, 2001, p. VII-A), and current extinction rates are estimated to be 1,000 to 10,000 times higher than natural extinction rates (Kellert and Wilson, 1993). As a result of these extinctions, natural systems that humans depend on are degraded or lost and the impact could be significant. Given current scientific knowledge, it is unclear at what point current biodiversity loss rates will lead to the breakdown of natural systems and cause significant problems. However, some evidence of problems already exists, for example, in California, significant habitat alterations and pesticide usage have degraded natural ecosystems so much that few wild bees are left. Farmers who relied on wild bees for pollination must now rent bees commercially to pollinate key agricultural crops (Pimentel et al., 1997).

Given such trends, there also is increasing emphasis on biodiversity in the policy, management, and public arenas. In fact, maintaining and preserving biodiversity is considered one of the most important environmental challenges of this century. Evidence for the global importance of biodiversity can be found with the signing of the Convention of Biodiversity by over 150 nations at the 1992 United Nations Earth Summit and the attention given to biodiversity conservation at the summer 2002 World Summit on Sustainable Development in Johannesburg, South Africa. We are also learning the importance of being strategic in preserving existing biodiversity. Scientists and natural resource managers know that "recovering species that have declined to low numbers or ecosystems that have been heavily degraded is far more expensive and problematic than maintaining our extant biodiversity" (Marshall et al., 2000).

⁴¹ These estimates are from Pimentel et al. (1997), which provides a quantitative assessment of biodiversity benefits.

⁴² For other approaches to arguing and quantifying the importance and benefits of biodiversity, see Daily et al. (1997); Stein, Kutner, and Adams (2000), and Smith and Smith (2001), pp. VII-A–VII-D.

Threats to Biodiversity

Biodiversity is being lost mainly because of increased human activities, such as sprawl, which result in habitat destruction, fragmentation, and degradation. Pollution and invasive species are also significant contributors to biodiversity losses. In the United States, the main threats to species come from habitat degradation and loss, alien species, pollution, overexploitation, and disease, with habitat degradation and loss being the largest problem, threatening an estimated 85 percent of species at risk. The spread of alien species is the second-greatest threat at 49 percent; pollution third at 24 percent; overexploitation fourth at 17 percent; and disease is last at 3 percent (Stein, Kutner, and Adams, 2000, p. 242).

The most widespread activities that cause habitat alteration are also the leading threats to endangered and threatened species as measured by the number of species they impact (Stein, Kutner, and Adams, 2000, p. 245). In the United States, the top three activities that threaten species and their habitats are agriculture (38 percent), land conversion for commercial development (35 percent), and water development (30 percent).⁴³ The next four are outdoor recreation, including off-road vehicles (27 percent), livestock grazing (22 percent), pollutants (20 percent), and infrastructure development, mostly roads (17 percent) (Stein, Kutner, and Adams, 2000, pp. 245–247). Disruption of fire ecology; logging; and mining, oil and gas, and geothermal activities are the next three most threatening activities. Military activities, such as training maneuvers and bombing practice, rank 11th, affecting about 4 percent of endangered and threatened species (Stein, Kutner, and Adams, 2000, p. 247).

Locations of Biodiversity at Risk

Next, it is useful to understand who owns the land where most of the endangered, threatened, and imperiled species and key habitats are at risk. In the United States, federally and privately owned lands harbor the greatest number of species and habitats that are at risk, though state lands are also significant.

The U.S. federal government owns about 400 million acres (not counting federal land in Alaska). These federal lands support at least one example of 59 percent of federally listed species⁴⁴ and a similar percentage of imperiled species,⁴⁵ while private lands support at least one population of more than half of all imperiled species and two-thirds of federally listed species (Stein, Kutner, and Adams, 2000, p. 283). State lands outside of Alaska

⁴³ Examples of water development activities are the building and maintenance of dams, levees, and irrigation systems.

⁴⁴ Federally listed species refers to the plant and animal species that are listed as endangered and threatened under the Federal Endangered Species Act.

⁴⁵ Stein, Kutner, and Adams (2000), pp. 278–279. Federally listed endangered and threatened species represent a relatively small portion of U.S. species considered at risk by scientists. Imperiled species refers to a fuller array of nearly 2,800 species identified by the Natural Heritage Network as being imperiled or vulnerable (Stein, Kutner, and Adams, 2000, p. 165).

include 90 million acres and harbor at least one example of 43 percent of imperiled species and 58 percent of federally listed species (Stein, Kutner, and Adams, 2000, p. 279).

However, “federal and private lands remain the two most important ownership types for listed species” (Stein, Kutner, and Adams, 2000, p. 282).

Within the category of federal lands, it is important to understand which federal agencies own the land where most species are at risk. Forest Service, Department of Defense, and Bureau of Land Management are the federal landowners with most federally listed and imperiled species and populations.

In fact, looking at the distribution of species and populations on federal lands,

...we find that Department of Defense lands contain the most federally listed species of any agency, with at least one example of about one-fifth (21%) of all federally listed species. This finding is particularly striking, given that these lands represent just 3% of the federal estate. Many military bases turn out to be strategically placed, not just from a military standpoint but also from a biological perspective. Often found in coastal areas with fast-growing human populations, many of the Department of Defense land holdings, such as southern California’s Camp Pendleton Marine Base, are becoming islands of natural habitat in rapidly urbanizing regions. (Stein, Kutner, and Adams, 2000, pp. 279–280)

Forest Service lands contain the greatest number of imperiled species at risk (26 percent) and the greatest number of imperiled and endangered populations. Given the amount of federal land that they own, both DoD and the Forest Service manage disproportionate numbers of imperiled and endangered species populations (Stein, Kutner, and Adams, 2000, p. 282). The significance of Army and other DoD lands for maintaining biodiversity is even larger given the designated uses and current management practices of Forest Service and Bureau of Land Management lands. These federal lands are managed for mixed uses including logging, grazing, mining, outdoor recreation, and oil and natural gas extraction. These activities are among the leading causes of habitat alteration and loss of species. If such activities on these lands increase, biodiversity losses are likely to increase, making Army and other military lands even more important for conserving biodiversity and serving as the remaining habitat for key endangered and threatened species populations. To avoid such a future, the Army and the other services should work strategically with the Department of the Interior and the Department of Agriculture to protect biodiversity on Bureau of Land Management and Forest Service lands.

C. Data Needed to Support Strategic Planning Issues

In this appendix, we review the data requirements of each of the strategic planning issues, except for analysis of long-term infrastructure risks and uncertainties, since that would be based on an evaluation of assumptions underlying current infrastructure planning rather than on data analysis. We also combine the issues related to current and future training capacity and long-term sustainability of training range usage, since these issues have largely overlapping data requirements.

Data Needed to Assess the Army's Deployment Infrastructure

- **Operational data**
 - Personnel and equipment associated with unit types
 - Expected frequency of deployments in “steady state” and “surge”
 - Facilities needed for “reachback” support facilities
 - Facilities and personnel needed to deliver additional family support services during deployments
- **Installation capacity and quality data**
 - Infrastructure available to prepare equipment and process soldiers
 - Infrastructure available to move equipment
 - Facilities available for “reachback” support
 - Facilities available for family support services
 - Type, capacity, and condition of existing infrastructure
- **Cost data**
 - Costs of building additional infrastructure and providing additional services to meet requirements

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Generally, three types of data are needed to assess the adequacy of the Army's deployment infrastructure. The first is operational data, specifically data pertaining to the units located at each installation (or reserve component units expected to mobilize at the installation) and their personnel and equipment that will require services and support for deployment. Operational data essentially drive the “demand” for deployment infrastructure. Given the number and types of personnel and equipment tied to each unit, the demand for deployment infrastructure is driven by the expected “steady-state” frequency of deployments for each unit (e.g., a maneuver brigade would deploy once every x years) plus the additional number of deployments expected under “surge” conditions. Once deployed, these units would generate additional requirements for facilities and personnel to deliver reachback support as well as additional support services for the families of deployed soldiers. Based on planning factors and recent experience, these operational data could be used to derive the requirements for deployment infrastructure.⁴⁶

The second type of data pertains to the capacity and quality of existing installation facilities and services. Installation capacity and quality data describe the “supply” of

⁴⁶ Typically, the Army computes requirements describing the types and capacities (often expressed in square feet) of the facilities that are needed to serve a population of a given size based on planning factors. So, for instance, dental facilities are sized according to the total military population on the installation.

infrastructure that is currently available. It includes the types and amounts of infrastructure and services used to prepare equipment for deployment, such as vehicle maintenance shops and aircraft maintenance hangars, as well as those used to house and prepare soldiers for deployment, including mobilization barracks. It includes the types and amounts of infrastructure used to move equipment, such as loading and unloading facilities and available railroad track. It also includes facilities available for reachback support as well as family support services. In addition to data on infrastructure type and capacity, one must also have data on the condition of existing infrastructure to understand what is truly available for use.

The difference between requirements for deployment infrastructure and the existing supply is what must be made up by new construction or modification of existing facilities. Hence, the third type of data is cost data regarding the capital costs of building additional infrastructure, the operating costs for managing this infrastructure, and the costs for providing additional services. In addition to estimating the cost of additional infrastructure needed to meet requirements, these data can also be used to determine which potential infrastructure solutions are more cost-effective than others. It should be pointed out that some of this cost data could vary by region. For example, the cost of information technology hardware such as routers or cabling would likely be the same regardless of where in U.S. additional facilities are built, but under the Davis-Bacon Act, the Army is required to pay locally prevailing union wages and fringe benefits for construction labor, which are set at the county level by the Department of Labor (U.S. Department of Labor, undated).

Data Needed to Develop Public/Private and Community Partnerships

- **Infrastructure demand data**
 - Increase in military and civilian personnel and dependents
 - Types and amounts of additional services needed (e.g., housing)
- **Installation and community capacity and quality data**
 - Changes over time in proportion of housing and community facilities provided on post vs. off post
 - Satisfaction with on- and off-post housing and community facilities
 - Local military and nonmilitary population and economic variables
 - Type, capacity, and condition of existing infrastructure
- **Cost data**
 - Capital & operating costs if Army vs. community fills infrastructure gap
 - Costs of programs to leverage private sector or community funds
 - User costs for on- and off-post housing and community facilities
- **Data about existing partnerships and community relationships**

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Similar to the analysis of the Army's deployment infrastructure, a study on developing public/private and community partnerships to provide family support facilities and services, such as housing, health care, child care, and entertainment, would require three types of data: expected demand for facilities and services, the existing quantity and quality of these facilities and services, and the costs of providing additional capacity, if needed. In this case, important demand data would include the net increase in military and civilian personnel, including the expected number of dependents, assigned to each installation as a result of initiatives such as BRAC and GDPR. Other data would include the types and amounts of additional services needed to support the increased population, based on planning factors and other sources.

Second, installation capacity and quality data are needed to determine the existing supply of infrastructure on post. However, some of the current needs are probably being met off post, in the local community, which could also be a source of additional capacity. Thus, for a given installation it would be useful to have data on the proportion of housing and community facilities provided on post versus off post and changes in the proportion over time, as well as data on the satisfaction of military families with on-post and off-post housing and community facilities. Other relevant data include information on the local military and

nonmilitary populations and local economic variables, as these can influence decisions, for example, by suggesting whether community facilities are likely to have spare capacity.

Third, data are needed on the costs of building and operating additional infrastructure both on post and off post, under different financing options, to assess alternative approaches to filling any gaps between expected future demand and existing infrastructure. Thus, it would be useful to know the capital and operating costs of military construction as well as the costs of public/private partnerships or community-provided solutions. These data should include the costs of existing programs that leverage private-sector or community funds, such as the Residential Communities Initiative for military housing. It is also important to know the costs that military families would incur for on-post versus off-post housing and community facilities, since these costs could affect the relative attractiveness of various alternatives.

Finally, information is needed on the Army's experience with existing partnerships and community relationships. Taking the Residential Communities Initiative as an example, it is instructive to gauge the costs and benefits of ongoing projects, the satisfaction of military customers, and any changes in use of on-post and off-post housing. These data can suggest whether it may be more beneficial for an installation to expand existing types of partnerships, modify them, or instead look toward new models of service provision.

Data Needed to Examine Infrastructure Needs at New Overseas Bases

- **Operational data**
 - Number of permanent and rotational forces
 - Type and frequency of training exercises supported
 - Type of contingency operations supported
 - Agreements with host nations
- **Installation capacity and quality data**
 - Infrastructure available to support operational needs
 - Infrastructure available to support quality of life
 - Type, capacity, and condition of existing infrastructure
- **Cost data**
 - Army costs to build additional infrastructure and provide additional services to meet requirements
 - Host nation costs to provide additional infrastructure and services

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As in the previous two cases, data requirements for examining infrastructure needs at Forward Operating Sites and Cooperative Security Locations include data on demand for facilities, the existing supply and quality of facilities, and the costs of various alternatives for providing additional facilities or improving existing facilities. Operational data are needed to estimate expected demand for particular types of facilities and services. It is necessary, for example, to know the number of permanent forces that will be stationed at a given Forward Operating Site or Cooperative Security Location and the types of units expected to rotate into these bases in order to estimate the types and amounts of operational facilities and quality-of-life services that are needed. Moreover, knowing the type and frequency of training exercises as well as the type of contingency operations that will need to be supported helps to estimate the amount of infrastructure and reachback capacity that are needed. In addition, agreements with host nations may affect the types of facilities and services that will be provided locally or brought in with rotating units or deploying forces.

The second type of data needed is installation capacity and quality data to capture the existing supply of infrastructure and services available to meet requirements for both operational and quality-of-life facilities. Accurate data on the quality of existing facilities is likely to be particularly important, since it can vary greatly depending on local standards and previous uses of the facilities.

Finally, data are needed to estimate the cost of meeting any additional infrastructure requirements. These should include the capital costs of building additional infrastructure, the operating costs of managing this infrastructure, and the costs of providing additional services. These costs are likely to depend on agreements with the host nation regarding whether the Army or the host nation will pay for additional facilities and whether U.S. or local contractors will perform the work.

Data Needed to Assess Training Capacity and Sustainability of Training Range Usage

- **Expected and future demand for training ranges**
 - Implications of BRAC, GDPR, and other troop and unit relocations
 - Future technology and doctrine implications
 - Weapon, vehicle, and maneuver size, space, use, and quality requirements
- **Current supply of training ranges**
 - Size, space, and quality
 - Use restrictions
- **Factors that limit training range sustainability and use**
 - Threatened and endangered species habitats and erosion problems
 - Encroachment
- **Options to enhance sustainability of training ranges and their use**
 - Sound ecosystem and land management practices
 - Land acquisition and encroachment buffering

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There are four types of data that are needed to assess current and future training capacity and the sustainability of training range usage: the expected current and future demand for training ranges; the supply of training ranges; factors that limit training range sustainability and use; and options to enhance sustainability of training ranges and their use.

Obtaining data on expected current and future demand for training ranges is likely to be complicated because these data need to account for changes in troop and unit locations, the training facilities needed by future weapon systems, and how the Army will fight and train in the future. Installation Land-Use Requirements Studies are useful sources for identifying current training range requirements and shortfalls. However, they may not be up to date and they do not attempt to assess the implications of future changes in stationing, training approaches, or technology. It is important to understand the implications of BRAC, GDPR, modularity, and other troop and unit relocations. Some of this information is available in documents on these initiatives. In addition, the office of the Assistant Chief of Staff for Installation Management is likely to be a good source of such information, since it implements infrastructure changes needed for Army transformation and plans for expected troop and unit relocations.

Data on the implications of changes in technology and doctrine are likely to be difficult to obtain. First, data are needed on the maneuver size and space, type of use, and

quality requirements of new weapons and vehicles. Over time, weapon systems have been evolving to fire over longer and longer distances, resulting in increased requirements for training space. However, we have not been able to locate any centralized source of information on expected maneuver size, space, and use requirements for new weapon systems. Such information may be available from Operational Requirements Documents or from the Office of the Deputy Chief of Staff, G-3/5/7,⁴⁷ which may also be a potential source of information on the training implications of future doctrine changes. Anticipating changes in doctrine is difficult, considering the changes in threats or strategies that could occur over a time horizon of 25 years or more. For example, as a result of the global war on terrorism, Military Operations on Urban Terrain training has become more important, and many installations have installed training ranges for urban operations. Ten years ago, it would have been difficult to anticipate such a change.

The second type of data is the current supply of training ranges, including information about their size, space, and quality and any restrictions on their use. Some of this information is available in installation Land-Use Requirements Studies and from the Army's sustainable range program. However, as we discussed in the main text, there are some difficulties with acquiring sufficient detail from centralized data, as well as the accuracy and timeliness of these data.

The third type of data concerns the factors that limit training range sustainability and use, including encroachment, threatened and endangered species habitat, and erosion problems. The Encroachment Condition Module is a good centralized source for data on encroachment. Installation Natural Resources Management Plans can provide information about habitat and threatened and endangered species locations on individual installations. Regional partnerships, such as the Southeast Regional Partnership for Planning and Sustainability, may provide this information for multiple bases in a region, but there is currently no good centralized Army source for such data. Nongovernmental organizations, such as The Nature Conservancy and NatureServe, have broader data on the locations of threatened and endangered species, but there are issues of timeliness and quality with any such national datasets.

The fourth main data need is information on options to enhance the sustainability of training ranges and their use. This information should include sound land and natural resource management and land acquisition and buffering activities. Information is needed about successful Army ecosystem management, adaptive management, and other sound land management practices, as well as other organizations that have been successfully managing the same types of ecosystems and lands. Individual bases that have been practicing longleaf pine ecosystem management, such as Fort Bragg, Fort Benning, and Eglin Air Force Base, are a good source of effective practices for similar land in the southeastern United States. Regional ecosystem and ecoregional collaborations (such as the Gulf Coastal Plain

⁴⁷ The Office of the Deputy Chief of Staff, G-3/5/7, has responsibility for Operations, Strategic Plans and Policy, Force Management, Training, Battle Command, and Capabilities Integration. See Department of the Army General Order 2005-3 (Department of the Army, 2005d).

Ecosystem Partnership in the southeast and the Central Shortgrass Prairie partnership in Colorado and four neighboring states) are also good sources for such practices. Other data sources include federal agencies, such as the Department of Agriculture for erosion management and the Department of the Interior for adaptive management practices; university research on natural resource management; and industry practices, such as sustainable forestry policies.

Information is also needed on current and future installation land acquisition and encroachment buffering. The Office of the Deputy Chief of Staff, G-3/5/7, is a good source for information about land acquisition plans. However, the political impediments and the long process for acquiring additional land for military training, especially when it may involve property condemnation, make it very difficult to accurately predict what land acquisitions will actually occur. The Army Compatible Use Buffer program is the best source of data on current encroachment buffering activities. However, again given the uncertainties regarding negotiations with private landowners and suburban and rural sprawl pressures, it is difficult to predict how much future buffering will occur at each installation. For example, an installation may have a plan to create a one-mile buffer around itself to prevent encroachment and may be negotiating with various large landowners about conservation easements, but if one or more of these landowners sell their land to developers, it may face the prospect of 10,000 housing units being built next to the fence line.

All these different approaches to land and natural resources need to be examined to help assess and develop approaches to ensure sustainable ranges.

Data Needed to Identify Other Federal Lands with Similar Ecosystems

- **Information about Army installations**
 - Which species, habitats, and ecosystems are at greatest risk with respect to biodiversity
 - Training, testing, and other operational restrictions due to threatened and endangered species, habitat, and ecosystem issues
 - Location of species and habitats that are most at risk (within a Geographic Information System)
- **Information about other federal lands, especially Bureau of Land Management and Forest Service lands**
 - Which specific locations have species, habitats, and ecosystems similar to those at risk on Army installations
 - Quantity and quality of these species and habitats
 - How these locations of interest are currently being managed
 - Which of these agencies' policies or programs could be used to help protect species on their lands

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There are two main types of data that are needed to identify other federal lands to relieve environmental pressure on Army land: information about Army installations and about other federal lands. It is important to keep in mind three issues concerning these types of data: the quality of the data, their currency, and whether they are integrated into a geographic information system to enable spatial analysis and assessments.

For installations, data are needed about species of conservation concern, which habitats and ecosystems located on the installation have the most biodiversity, and whether that biodiversity is at risk. This includes threatened and endangered species, but it also includes other species of concern, such as state-protected species. Many Army installations have good data on threatened and endangered species, but may have more limited data on other species and habitats of concern. Also, the data may not be current. For example, Installation Natural Resources Management Plans usually contain much of these data, but they are only updated about every five years. Ideally, such data should be in a GIS database, but they may not be. In addition, it is time consuming to acquire these data from each installation and currently, there is no centralized source. However, some integrated regional data can be obtained from regional collaborations, such as the Southeast Regional Partnership for Planning and Sustainability.

It also is important to have data about current and potential future training, testing, and other operational restrictions because of threatened and endangered species and other species, habitat, and ecosystem issues. Installation range and environmental management offices track this information, so data are available at the installations. In some cases, these data are in the installation's GIS database, such as Fort Benning's data on training areas that are restricted because of an endangered plant species. The Encroachment Condition Module is intended to be a national source for such data, but it has not yet been used at many installations.

For other federal lands, the same type of information is needed for the species, habitats, and ecosystems of concern that were identified on Army installations. For example, at many installations in the Southeast, such as Fort Benning, Fort Bragg and Fort Stewart, the longleaf pine ecosystem and its key species, including the red-cockaded woodpecker and gopher tortoise, are of greatest concern. Therefore, one would need to know where the longleaf pine ecosystem and species can be found on other federal lands. At Fort Carson, the central shortgrass prairie ecoregion and its key species, including the mountain plover, black-tailed prairie dog, and round-leaf four o'clock, are the most important to identify on other federal lands. Sources for data about species and habitats on federal land include the agencies that own the land, such as the Bureau of Land Management and Forest Service, as well as the U.S. Geological Survey, NatureServe, and The Nature Conservancy. Ecosystem and ecoregional assessments and collaborations, such as the Central Shortgrass Prairie and Gulf Coastal Plain Ecosystem Partnerships, are good sources of integrated data for ecosystems and ecoregions.

When the federal lands containing the relevant ecosystems and species have been identified, it is also important to be able to assess the quantity and quality of the species and habitats, how the lands are currently being managed, and what policies the agencies that own them could use to more effectively manage and protect species and habitats. Regional collaborations, such as the Gulf Coastal Plain Ecosystem and Central Shortgrass Prairie Partnerships, are good sources of information on land management and the quantity and quality of species and habitats of concern. Forest Service and Bureau of Land Management regional and local managers for the lands of interest are other potential sources of information on land management and applicable policies. Studying these agencies' current and past national and regional policies, including policies on road building, oil and gas drilling, wilderness, and other multiple uses of the land, can also help determine management approaches and policy options.

The ultimate goal of this effort is to encourage better planning and management on other federal lands in order to protect and restore habitats and to prevent species from becoming listed as threatened or endangered, which can cause restrictions on military training. A valuable metric for tracking the success of this effort is the status of the species of concern and habitats on all lands, but especially on other federal lands, to monitor whether the health and long-term sustainability of the habitats and species are improving. For example, if the red-cockaded woodpecker and other species of concern in the longleaf pine ecosystem have recovered and no longer need to be listed as threatened or endangered

species as a result of proactive management practices by the Gulf Coastal Plain Ecosystem Partnership, Forest Service, Army, and other longleaf pine landowners, then the ultimate goal of this project is being achieved, because the red-cockaded woodpecker and concerns about the longleaf pine ecosystem would no longer impose restrictions on Army training.

Data Needed to Preserve Farmland as a Buffer Against Encroachment

- **Information about key Army installations**
 - Which installations have key testing, training, and other missions
 - These installations' current encroachment problems
 - Potential encroachment concerns and restrictions on operations if development occurred nearby
- **Information about the area surrounding key Army installations**
 - Which of these installations have farmland next to them
 - Development trends and pressures for these areas
- **Information about Department of Agriculture farm conservation activities and policies**
 - Programs and funding sources that can be used to protect farmland
 - How the Army can partner with the Department of Agriculture to use these programs to prevent encroachment around Army bases

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For efforts to preserve farmland near Army installations as a buffer against encroachment, three types of data are needed: information about installations, about the lands surrounding the installations, and about Department of Agriculture farm conservation policies. For the latter two types of data, it is important to have such data in a GIS system to enable the analysis of spatial relationships.

First, data are needed to identify which installations have key testing, training, and other missions and the encroachment problems they face. The office of the Deputy Chief of Staff, G-3/5/7, is a good source of information about key training installations. Another useful source is the Army's 2005 BRAC report and supporting data, which identify installations' key capabilities. The Army sustainable ranges program also has detailed data on Army training ranges, and more importantly, it is a centralized source of such data in a GIS database. These three sources could also provide some information about encroachment around installations. Additional data on current encroachment issues can be obtained from the Encroachment Condition Module and the Army Compatible Use Buffer program. Installations themselves are also good sources of data on encroachment.

Second, data are needed about the land surrounding installations, especially farmland, including land used for agriculture, forestry, and ranching, as well as local trends and pressures on these farmlands. Most installations participating in the Army Compatible

Use Buffer program have extensive GIS data on nearby land use. For others, additional data sources include state and local governments, the Department of Agriculture, the American Farmland Trust, and state land trusts. These organizations also have information about local trends and pressures.

Last, information is needed about Department of Agriculture farm conservation activities and policies that could be used to protect farmland near Army installations. The Department of Agriculture, Farm Service Agency, and Natural Resources Conservation Service are key sources for such information. In addition, it is important to understand state and local government policies that can be used to help preserve farmland, so these entities can be useful sources of information. The American Farmland Trust can also provide information on farm conservation activities and policies.

Data Needed to Develop Strategic Guidance for Installation Sustainability Plans

- **Information about current Army installation sustainability plans**
 - Approach and practices for mission, environment, and community concerns
- **Information about industry and community sustainability approaches and relevant practices**
 - Operational issues
 - Community concerns, such as quality of life
 - Environmental issues, such as air, water, energy, land use, and species/habitat concerns
 - Built environment/infrastructure, such as buildings, roads, utilities, and master planning

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There are two main types of data that are needed to develop strategic guidance for installation sustainability plans: information on sustainability approaches and practices from the Army and from other organizations. For the most part, this information is not currently available from a centralized source and would need to be collected.

First, Army information should include examples of Installation Sustainability Plans and any existing guidance on developing them, focusing on approaches and practices for addressing mission, environment, and community concerns. This information would most likely need to be acquired by examining the Installation Sustainability Plans and the planning process that occurred at the installations that have developed these plans. Since only about a dozen installations have developed sustainability plans so far, these installations could be contacted directly. Many of them are collaborating with local communities and looking at broader regional sustainability issues, such as sprawl, air quality and watershed health. As a result, they provide information about their Installation Sustainability Plans on the Internet.⁴⁸ Interviewing base staff and attending installation sustainability conferences would also be useful for acquiring such information. For example, Fort Carson organizes an annual sustainability conference that was attended by over 300 people in November 2006.

⁴⁸ See, for example, Fort Bragg (2006) and Fort Lewis (2007).

In addition, there is some limited Army guidance on the installation sustainability planning process. In spring 2006, the Installation Management Command Southeast Region developed an informal guide on installation sustainability planning in order to provide tools to other installations that may wish to initiate similar processes.

Second, information about industry and community sustainability approaches and relevant practices is needed. Since industry and community sustainability approaches cover a wide range of topics, it is important to address those that are most relevant to Army installations. Relevant topics would include general community concerns, such as quality of life; environmental issues, such as air, water, energy, land-use, and species/habitat concerns; and built environment/infrastructure issues, such as buildings, roads, utilities, and master planning. In addition, operational issues related to managing and running facilities similar to those located on military installations, such as industrial and logistics sites, mixed residential housing, commercial facilities, and large tracts of land that have natural resource concerns, should be examined.

The World Business Council for Sustainable Development is a useful source of information on industry sustainability initiatives. It consists of over 180 international companies in a shared commitment to sustainable development through economic growth, ecological balance, and social progress. It collects and provides information on sustainable practices. The World Business Council for Sustainable Development and other industry leaders in sustainability could help identify facilities that have similar processes and activities to Army bases. The sustainability approaches and practices used by these facilities and companies could be examined for lessons for the Army. Understanding economies of scale and synergies across multiple facilities would also be important.

Since an Army installation is often more like a city or town than a corporation, it is important to examine sustainable community activities as well. Identifying successful U.S. state and community sustainability activities, as well as international ones, could be a starting point for finding relevant information. For example, the state of Minnesota has active sustainable development and community programs in state and local agencies, as well as other organizations.⁴⁹ The Minnesota Sustainable Communities Network consists of individuals, nonprofit organizations, businesses, local governments, educational institutions, and other organizations in Minnesota (and bordering areas) who are interested in moving toward sustainability. The Minnesota Sustainable Development Initiative is a collaborative organization of business, government, and civic interests to promote policies, institutions, and actions that ensure Minnesota's long-term environmental, economic, and social well-being. There are many other examples of industry and community sustainability activities (many of which are referenced on the Internet) that could be examined for practices and approaches relevant for the Army.

⁴⁹ For more information, see Minnesota Pollution Control Agency (2007) and Minnesota Department of Administration (undated).

It is also useful to note that there is a large body of literature on sustainability metrics that could be reviewed to identify measures of progress and help installations set appropriate goals for their Installation Sustainability Plans.

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